τ

$J = \frac{1}{2}$

τ discovery paper was PERL 75. $e^+ e^- \rightarrow \tau^+ \tau^-$ cross-section threshold behavior and magnitude are consistent with pointlike spin-1/2 Dirac particle. BRANDELIK 78 ruled out pointlike spin-0 or spin-1 particle. FELDMAN 78 ruled out $J = 3/2$. KIRKBY 79 also ruled out J=integer, $J = 3/2$.

τ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{1776.99^{+0.29}_{-0.26}}$ **OUR AVERAGE**					
1775.1 $\pm$1.6 $\pm$1.0	13.3k	[1] ABBIENDI	00A	OPAL	1990–1995 LEP runs
1778.2 $\pm$0.8 $\pm$1.2		ANASTASSOV	97	CLEO	E^{ee}_{cm}= 10.6 GeV
$1776.96^{+0.18}_{-0.21}{}^{+0.25}_{-0.17}$	65	[2] BAI	96	BES	E^{ee}_{cm}= 3.54–3.57 GeV
1776.3 $\pm$2.4 $\pm$1.4	11k	[3] ALBRECHT	92M	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
$1783\ ^{+3}_{-4}$	692	[4] BACINO	78B	DLCO	E^{ee}_{cm}= 3.1–7.4 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1777.8 $\pm$0.7 $\pm$1.7	35k	[5] BALEST	93	CLEO	Repl. by ANASTASSOV 97
$1776.9\ ^{+0.4}_{-0.5}$ $\pm$0.2	14	[6] BAI	92	BES	Repl. by BAI 96

[1] ABBIENDI 00A fit τ pseudomass spectrum in $\tau \rightarrow \pi^{\pm} \leq 2\pi^0 \nu_\tau$ and $\tau \rightarrow \pi^{\pm}\pi^+\pi^- \leq 1\pi^0 \nu_\tau$ decays. Result assumes m_{ν_τ}=0.

[2] BAI 96 fit $\sigma(e^+ e^- \rightarrow \tau^+ \tau^-)$ at different energies near threshold.

[3] ALBRECHT 92M fit τ pseudomass spectrum in $\tau^- \rightarrow 2\pi^- \pi^+ \nu_\tau$ decays. Result assumes m_{ν_τ}=0.

[4] BACINO 78B value comes from $e^{\pm} X^{\mp}$ threshold. Published mass 1782 MeV increased by 1 MeV using the high precision $\psi(2S)$ mass measurement of ZHOLENTZ 80 to eliminate the absolute SPEAR energy calibration uncertainty.

[5] BALEST 93 fit spectra of minimum kinematically allowed τ mass in events of the type $e^+ e^- \rightarrow \tau^+ \tau^- \rightarrow (\pi^+ n\pi^0 \nu_\tau)(\pi^- m\pi^0 \nu_\tau)$ $n \leq 2$, $m \leq 2$, $1 \leq n+m \leq 3$. If $m_{\nu_\tau} \neq 0$, result increases by ($m^2_{\nu_\tau}$/1100 MeV).

[6] BAI 92 fit $\sigma(e^+ e^- \rightarrow \tau^+ \tau^-)$ near threshold using $e\mu$ events.

$(m_{\tau^+} - m_{\tau^-})/m_{\text{average}}$

A test of *CPT* invariance.

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{<3.0 \times 10^{-3}}$	90	ABBIENDI	00A	OPAL	1990–1995 LEP runs

τ MEAN LIFE

VALUE (10^{-15} s)	EVTS	DOCUMENT ID		TECN	COMMENT
290.6± 1.0 OUR AVERAGE					
290.9± 1.4± 1.0		ABDALLAH	04T	DLPH	1991-1995 LEP runs
293.2± 2.0± 1.5		ACCIARRI	00B	L3	1991–1995 LEP runs
290.1± 1.5± 1.1		BARATE	97R	ALEP	1989–1994 LEP runs
289.2± 1.7± 1.2		ALEXANDER	96E	OPAL	1990–1994 LEP runs
289.0± 2.8± 4.0	57.4k	BALEST	96	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
291.2± 2.0± 1.2		BARATE	97I	ALEP	Repl. by BARATE 97R
291.4± 3.0		ABREU	96B	DLPH	Repl. by ABDALLAH 04T
290.1± 4.0	34k	ACCIARRI	96K	L3	Repl. by ACCIARRI 00B
297 ± 9 ± 5	1671	ABE	95Y	SLD	1992–1993 SLC runs
304 ± 14 ± 7	4100	BATTLE	92	CLEO	E^{ee}_{cm}= 10.6 GeV
301 ± 29	3780	KLEINWORT	89	JADE	E^{ee}_{cm}= 35–46 GeV
288 ± 16 ±17	807	AMIDEI	88	MRK2	E^{ee}_{cm}= 29 GeV
306 ± 20 ±14	695	BRAUNSCH...	88C	TASS	E^{ee}_{cm}= 36 GeV
299 ± 15 ±10	1311	ABACHI	87C	HRS	E^{ee}_{cm}= 29 GeV
295 ± 14 ±11	5696	ALBRECHT	87P	ARG	E^{ee}_{cm}= 9.3–10.6 GeV
309 ± 17 ± 7	3788	BAND	87B	MAC	E^{ee}_{cm}= 29 GeV
325 ± 14 ±18	8470	BEBEK	87C	CLEO	E^{ee}_{cm}= 10.5 GeV
460 ±190	102	FELDMAN	82	MRK2	E^{ee}_{cm}= 29 GeV

τ MAGNETIC MOMENT ANOMALY

The q^2 dependence is expected to be small providing no thresholds are nearby.

$\mu_\tau/(e\hbar/2m_\tau)-1 = (g_\tau-2)/2$

For a theoretical calculation $[(g_\tau-2)/2 = 11773(3) \times 10^{-7}]$, see SAMUEL 91B.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
> −0.052 and < 0.013 (CL = 95%) OUR LIMIT					
> −0.052 and < 0.013	95	[7] ABDALLAH	04K	DLPH	$e^+e^- \to e^+e^-\tau^+\tau^-$ at LEP2
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.107	95	[8] ACHARD	04G	L3	$e^+e^- \to e^+e^-\tau^+\tau^-$ at LEP2
> −0.007 and < 0.005	95	[9] GONZALEZ-S...	00	RVUE	$e^+e^- \to \tau^+\tau^-$ and $W \to \tau\nu_\tau$
> −0.052 and < 0.058	95	[10] ACCIARRI	98E	L3	1991–1995 LEP runs
> −0.068 and < 0.065	95	[11] ACKERSTAFF	98N	OPAL	1990–1995 LEP runs
> −0.004 and < 0.006	95	[12] ESCRIBANO	97	RVUE	$Z \to \tau^+\tau^-$ at LEP
<0.01	95	[13] ESCRIBANO	93	RVUE	$Z \to \tau^+\tau^-$ at LEP
<0.12	90	GRIFOLS	91	RVUE	$Z \to \tau\tau\gamma$ at LEP
<0.023	95	[14] SILVERMAN	83	RVUE	$e^+e^- \to \tau^+\tau^-$ at PETRA

[7] ABDALLAH 04K limit is derived from $e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ total cross-section measurements at $\sqrt{s}$ between 183 and 208 GeV. In addition to the limits, the authors also quote a value of -0.018 ± 0.017.

[8] ACHARD 04G limit is derived from $e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ total cross-section measurements at $\sqrt{s}$ between 189 and 206 GeV, and is on the absolute value of the magnetic moment anomaly.

[9] GONZALEZ-SPRINBERG 00 use data on tau lepton production at LEP1, SLC, and LEP2, and data from colliders and LEP2 to determine limits. Assume imaginary component is zero.

[10] ACCIARRI 98E use $Z \rightarrow \tau^+ \tau^- \gamma$ events. In addition to the limits, the authors also quote a value of $0.004 \pm 0.027 \pm 0.023$.

[11] ACKERSTAFF 98N use $Z \rightarrow \tau^+ \tau^- \gamma$ events. The limit applies to an average of the form factor for off-shell τ's having p^2 ranging from m_τ^2 to $(M_Z - m_\tau)^2$.

[12] ESCRIBANO 97 use preliminary experimental results.

[13] ESCRIBANO 93 limit derived from $\Gamma(Z \rightarrow \tau^+ \tau^-)$, and is on the absolute value of the magnetic moment anomaly.

[14] SILVERMAN 83 limit is derived from $e^+ e^- \rightarrow \tau^+ \tau^-$ total cross-section measurements for q^2 up to $(37\ \text{GeV})^2$.

τ ELECTRIC DIPOLE MOMENT (d_τ)

A nonzero value is forbidden by both T invariance and P invariance.

The q^2 dependence is expected to be small providing no thresholds are nearby.

Re(d_τ)

VALUE (10^{-16} e cm)	CL%	DOCUMENT ID		TECN	COMMENT
− 0.22 to 0.45	95	[15] INAMI	03	BELL	$E^{ee}_{cm} = 10.6$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 3.7	95	[16] ABDALLAH	04K	DLPH	$e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ at LEP2
$<$ 11.4	95	[17] ACHARD	04G	L3	$e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ at LEP2
$<$ 4.6	95	[18] ALBRECHT	00	ARG	$E^{ee}_{cm} = 10.4$ GeV
> -3.1 and < 3.1	95	ACCIARRI	98E	L3	1991–1995 LEP runs
> -3.8 and < 3.6	95	[19] ACKERSTAFF	98N	OPAL	1990–1995 LEP runs
$<$ 0.11	95	[20,21] ESCRIBANO	97	RVUE	$Z \rightarrow \tau^+ \tau^-$ at LEP
$<$ 0.5	95	[22] ESCRIBANO	93	RVUE	$Z \rightarrow \tau^+ \tau^-$ at LEP
$<$ 7	90	GRIFOLS	91	RVUE	$Z \rightarrow \tau \tau \gamma$ at LEP
$<$ 1.6	90	DELAGUILA	90	RVUE	$e^+ e^- \rightarrow \tau^+ \tau^-$ $E^{ee}_{cm} = 35$ GeV

[15] INAMI 03 use $e^+ e^- \rightarrow \tau^+ \tau^-$ events.

[16] ABDALLAH 04K limit is derived from $e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ total cross-section measurements at $\sqrt{s}$ between 183 and 208 GeV and is on the absolute value of d_τ.

[17] ACHARD 04G limit is derived from $e^+ e^- \rightarrow e^+ e^- \tau^+ \tau^-$ total cross-section measurements at $\sqrt{s}$ between 189 and 206 GeV, and is on the absolute value of d_τ.

[18] ALBRECHT 00 use $e^+ e^- \rightarrow \tau^+ \tau^-$ events. Limit is on the absolute value of Re(d_τ).

[19] ACKERSTAFF 98N use $Z \rightarrow \tau^+ \tau^- \gamma$ events. The limit applies to an average of the form factor for off-shell τ's having p^2 ranging from m_τ^2 to $(M_Z - m_\tau)^2$.

[20] ESCRIBANO 97 derive the relationship $|d_\tau| = \cot\theta_W \, |d_\tau^W|$ using effective Lagrangian methods, and use a conference result $|d_\tau^W| < 5.8\times10^{-18}\, e\,$cm at 95% CL (L. Silvestris, ICHEP96) to obtain this result.
[21] ESCRIBANO 97 use preliminary experimental results.
[22] ESCRIBANO 93 limit derived from $\Gamma(Z \to \tau^+\tau^-)$, and is on the absolute value of the electric dipole moment.

Im(d_τ)

VALUE (10^{-16} e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
−0.25 to 0.008	95	[23] INAMI	03	BELL	$E^{ee}_{\rm cm}$= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.8	95	[24] ALBRECHT	00	ARG	$E^{ee}_{\rm cm}$= 10.4 GeV

[23] INAMI 03 use $e^+e^- \to \tau^+\tau^-$ events.
[24] ALBRECHT 00 use $e^+e^- \to \tau^+\tau^-$ events. Limit is on the absolute value of Im(d_τ).

τ WEAK DIPOLE MOMENT (d_τ^w)

A nonzero value is forbidden by *CP* invariance.

The q^2 dependence is expected to be small providing no thresholds are nearby.

Re(d_τ^w)

VALUE (10^{-17} e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.50	95	[25] HEISTER	03F	ALEP	1990–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.0	90	[25] ACCIARRI	98C	L3	1991–1995 LEP runs
<0.56	95	ACKERSTAFF	97L	OPAL	1991–1995 LEP runs
<0.78	95	[26] AKERS	95F	OPAL	Repl. by ACKERSTAFF 97L
<1.5	95	[26] BUSKULIC	95C	ALEP	Repl. by HEISTER 03F
<7.0	95	[26] ACTON	92F	OPAL	$Z \to \tau^+\tau^-$ at LEP
<3.7	95	[26] BUSKULIC	92J	ALEP	Repl. by BUSKULIC 95C

[25] Limit is on the absolute value of the real part of the weak dipole moment.
[26] Limit is on the absolute value of the real part of the weak dipole moment, and applies for $q^2 = m_Z^2$.

Im(d_τ^w)

VALUE (10^{-17} e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.1	95	[27] HEISTER	03F	ALEP	1990–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.5	95	ACKERSTAFF	97L	OPAL	1991–1995 LEP runs
<4.5	95	[28] AKERS	95F	OPAL	Repl. by ACKERSTAFF 97L

[27] HEISTER 03F limit is on the absolute value of the imaginary part of the weak dipole moment.
[28] Limit is on the absolute value of the imaginary part of the weak dipole moment, and applies for $q^2 = m_Z^2$.

τ WEAK ANOMALOUS MAGNETIC DIPOLE MOMENT (α_τ^w)

Electroweak radiative corrections are expected to contribute at the 10^{-6} level. See BERNABEU 95.

The q^2 dependence is expected to be small providing no thresholds are nearby.

Re(α_τ^w)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.1 \times 10^{-3}$	95	[29] HEISTER	03F	ALEP	1990–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
> -0.0024 and < 0.0025	95	[30] GONZALEZ-S...	00	RVUE	$e^+e^- \to \tau^+\tau^-$ and $W \to \tau\nu_\tau$
$<4.5 \times 10^{-3}$	90	[29] ACCIARRI	98C	L3	1991–1995 LEP runs

[29] Limit is on the absolute value of the real part of the weak anomalous magnetic dipole moment.

[30] GONZALEZ-SPRINBERG 00 use data on tau lepton production at LEP1, SLC, and LEP2, and data from colliders and LEP2 to determine limits. Assume imaginary component is zero.

Im(α_τ^w)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.7 \times 10^{-3}$	95	[31] HEISTER	03F	ALEP	1990–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<9.9 \times 10^{-3}$	90	[31] ACCIARRI	98C	L3	1991–1995 LEP runs

[31] Limit is on the absolute value of the imaginary part of the weak anomalous magnetic dipole moment.

τ^- DECAY MODES

τ^+ modes are charge conjugates of the modes below. "$h^\pm$" stands for $\pi^\pm$ or $K^\pm$. "ℓ" stands for e or μ. "Neutrals" stands for γ's and/or π^0's.

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Modes with one charged particle			
Γ_1	particle$^-$ ≥ 0 neutrals $\geq 0K^0\nu_\tau$ ("1-prong")		(85.33 ± 0.08) %	S=1.4
Γ_2	particle$^-$ ≥ 0 neutrals $\geq 0K^0_L\nu_\tau$		(84.69 ± 0.09) %	S=1.4
Γ_3	$\mu^-\overline{\nu}_\mu\nu_\tau$	[a]	(17.36 ± 0.05) %	
Γ_4	$\mu^-\overline{\nu}_\mu\nu_\tau\gamma$	[b]	$(3.6\pm0.4) \times 10^{-3}$	
Γ_5	$e^-\overline{\nu}_e\nu_\tau$	[a]	(17.84 ± 0.05) %	
Γ_6	$e^-\overline{\nu}_e\nu_\tau\gamma$	[b]	(1.75 ± 0.18) %	
Γ_7	$h^- \geq 0K^0_L\ \nu_\tau$		(12.14 ± 0.07) %	S=1.1
Γ_8	$h^-\nu_\tau$		(11.59 ± 0.06) %	S=1.1
Γ_9	$\pi^-\nu_\tau$	[a]	(10.90 ± 0.07) %	S=1.1
Γ_{10}	$K^-\nu_\tau$	[a]	$(6.91\pm0.23) \times 10^{-3}$	

Γ_{11}	$h^- \geq 1$ neutrals ν_τ		(37.05 ± 0.12) %	S=1.3
Γ_{12}	$h^- \geq 1\pi^0 \nu_\tau$ (ex.K^0)		(36.51 ± 0.12) %	S=1.3
Γ_{13}	$h^- \pi^0 \nu_\tau$		(25.95 ± 0.10) %	S=1.1
Γ_{14}	$\pi^- \pi^0 \nu_\tau$	[a]	(25.50 ± 0.10) %	S=1.1
Γ_{15}	$\pi^- \pi^0$ non-$\rho(770) \nu_\tau$		$(3.0 \pm3.2) \times 10^{-3}$	
Γ_{16}	$K^- \pi^0 \nu_\tau$	[a]	$(4.52\pm0.27) \times 10^{-3}$	
Γ_{17}	$h^- \geq 2\pi^0 \nu_\tau$		(10.81 ± 0.14) %	S=1.5
Γ_{18}	$h^- 2\pi^0 \nu_\tau$		(9.47 ± 0.12) %	S=1.3
Γ_{19}	$h^- 2\pi^0 \nu_\tau$ (ex.K^0)		(9.31 ± 0.12) %	S=1.3
Γ_{20}	$\pi^- 2\pi^0 \nu_\tau$ (ex.K^0)	[a]	(9.25 ± 0.12) %	S=1.3
Γ_{21}	$\pi^- 2\pi^0 \nu_\tau$ (ex.K^0), scalar		$< 9 \times 10^{-3}$	CL=95%
Γ_{22}	$\pi^- 2\pi^0 \nu_\tau$ (ex.K^0), vector		$< 7 \times 10^{-3}$	CL=95%
Γ_{23}	$K^- 2\pi^0 \nu_\tau$ (ex.K^0)	[a]	$(5.8 \pm2.3) \times 10^{-4}$	
Γ_{24}	$h^- \geq 3\pi^0 \nu_\tau$		(1.33 ± 0.07) %	S=1.1
Γ_{25}	$h^- \geq 3\pi^0 \nu_\tau$ (ex. K^0)		(1.25 ± 0.07) %	S=1.1
Γ_{26}	$h^- 3\pi^0 \nu_\tau$		(1.17 ± 0.08) %	S=1.1
Γ_{27}	$\pi^- 3\pi^0 \nu_\tau$ (ex.K^0)	[a]	(1.04 ± 0.08) %	S=1.1
Γ_{28}	$K^- 3\pi^0 \nu_\tau$ (ex.K^0, η)	[a]	$(4.2 \pm2.1) \times 10^{-4}$	
Γ_{29}	$h^- 4\pi^0 \nu_\tau$ (ex.K^0)		$(1.6 \pm0.4) \times 10^{-3}$	
Γ_{30}	$h^- 4\pi^0 \nu_\tau$ (ex.K^0,η)	[a]	$(1.0 \pm0.4) \times 10^{-3}$	
Γ_{31}	$K^- \geq 0\pi^0 \geq 0K^0 \geq 0\gamma\ \nu_\tau$		(1.57 ± 0.04) %	S=1.1
Γ_{32}	$K^- \geq 1\ (\pi^0$ or K^0 or $\gamma)\ \nu_\tau$		$(8.78\pm0.33) \times 10^{-3}$	

Modes with K^0's

Γ_{33}	K^0_S (particles)$^- \nu_\tau$		$(9.27\pm0.34) \times 10^{-3}$	S=1.1
Γ_{34}	$h^- \overline{K}^0 \nu_\tau$		(1.05 ± 0.04) %	S=1.1
Γ_{35}	$\pi^- \overline{K}^0 \nu_\tau$	[a]	$(9.0 \pm0.4) \times 10^{-3}$	S=1.1
Γ_{36}	$\pi^- \overline{K}^0$ (non-$K^*(892)^-$) ν_τ		$< 1.7 \times 10^{-3}$	CL=95%
Γ_{37}	$K^- K^0 \nu_\tau$	[a]	$(1.53\pm0.16) \times 10^{-3}$	
Γ_{38}	$K^- K^0 \geq 0\pi^0 \nu_\tau$		$(3.07\pm0.24) \times 10^{-3}$	
Γ_{39}	$h^- \overline{K}^0 \pi^0 \nu_\tau$		$(5.3 \pm0.4) \times 10^{-3}$	
Γ_{40}	$\pi^- \overline{K}^0 \pi^0 \nu_\tau$	[a]	$(3.8 \pm0.4) \times 10^{-3}$	
Γ_{41}	$\overline{K}^0 \rho^- \nu_\tau$		$(2.2 \pm0.5) \times 10^{-3}$	
Γ_{42}	$K^- K^0 \pi^0 \nu_\tau$	[a]	$(1.54\pm0.20) \times 10^{-3}$	
Γ_{43}	$\pi^- \overline{K}^0 \geq 1\pi^0 \nu_\tau$		$(3.2 \pm1.0) \times 10^{-3}$	
Γ_{44}	$\pi^- \overline{K}^0 \pi^0 \pi^0 \nu_\tau$		$(2.6 \pm2.4) \times 10^{-4}$	
Γ_{45}	$K^- K^0 \pi^0 \pi^0 \nu_\tau$		$< 1.6 \times 10^{-4}$	CL=95%
Γ_{46}	$\pi^- K^0 \overline{K}^0 \nu_\tau$		$(1.60\pm0.31) \times 10^{-3}$	S=1.2
Γ_{47}	$\pi^- K^0_S K^0_S \nu_\tau$	[a]	$(2.4 \pm0.5) \times 10^{-4}$	
Γ_{48}	$\pi^- K^0_S K^0_L \nu_\tau$	[a]	$(1.12\pm0.30) \times 10^{-3}$	S=1.2
Γ_{49}	$\pi^- K^0 \overline{K}^0 \pi^0 \nu_\tau$		$(3.1 \pm2.3) \times 10^{-4}$	
Γ_{50}	$\pi^- K^0_S K^0_S \pi^0 \nu_\tau$		$< 2.0 \times 10^{-4}$	CL=95%

Γ_{51}	$\pi^- K^0_S K^0_L \pi^0 \nu_\tau$		$(3.1 \pm 1.2) \times 10^{-4}$	
Γ_{52}	$K^0 h^+ h^- h^- \geq 0$ neutrals ν_τ		$< 1.7 \times 10^{-3}$	CL=95%
Γ_{53}	$K^0 h^+ h^- h^- \nu_\tau$		$(2.3 \pm 2.0) \times 10^{-4}$	

Modes with three charged particles

Γ_{54}	$h^- h^- h^+ \geq 0$ neutrals $\geq 0 K^0_L \nu_\tau$		(15.22 ± 0.09) %	S=1.4
Γ_{55}	$h^- h^- h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^+ \pi^-$) ("3-prong")		(14.59 ± 0.08) %	S=1.4
Γ_{56}	$h^- h^- h^+ \nu_\tau$		(9.87 ± 0.08) %	S=1.3
Γ_{57}	$h^- h^- h^+ \nu_\tau$ (ex.K^0)		(9.51 ± 0.08) %	S=1.3
Γ_{58}	$h^- h^- h^+ \nu_\tau$ (ex.K^0,ω)		(9.47 ± 0.08) %	S=1.3
Γ_{59}	$\pi^- \pi^+ \pi^- \nu_\tau$		(9.33 ± 0.08) %	S=1.3
Γ_{60}	$\pi^- \pi^+ \pi^- \nu_\tau$ (ex.K^0)		(9.02 ± 0.08) %	S=1.3
Γ_{61}	$\pi^- \pi^+ \pi^- \nu_\tau$ (ex.K^0), non-axial vector		< 2.4 %	CL=95%
Γ_{62}	$\pi^- \pi^+ \pi^- \nu_\tau$ (ex.K^0,ω)	[a]	(8.99 ± 0.08) %	S=1.3
Γ_{63}	$h^- h^- h^+ \geq 1$ neutrals ν_τ		(5.34 ± 0.06) %	S=1.1
Γ_{64}	$h^- h^- h^+ \geq 1 \pi^0 \nu_\tau$ (ex. K^0)		(5.06 ± 0.06) %	S=1.1
Γ_{65}	$h^- h^- h^+ \pi^0 \nu_\tau$		(4.73 ± 0.07) %	S=1.2
Γ_{66}	$h^- h^- h^+ \pi^0 \nu_\tau$ (ex.K^0)		(4.55 ± 0.06) %	S=1.2
Γ_{67}	$h^- h^- h^+ \pi^0 \nu_\tau$ (ex. K^0, ω)		(2.78 ± 0.08) %	S=1.2
Γ_{68}	$\pi^- \pi^+ \pi^- \pi^0 \nu_\tau$		(4.59 ± 0.07) %	S=1.2
Γ_{69}	$\pi^- \pi^+ \pi^- \pi^0 \nu_\tau$ (ex.K^0)		(4.46 ± 0.06) %	S=1.2
Γ_{70}	$\pi^- \pi^+ \pi^- \pi^0 \nu_\tau$ (ex.K^0,ω)	[a]	(2.69 ± 0.08) %	S=1.2
Γ_{71}	$h^- \rho \pi^0 \nu_\tau$			
Γ_{72}	$h^- \rho^+ h^- \nu_\tau$			
Γ_{73}	$h^- \rho^- h^+ \nu_\tau$			
Γ_{74}	$h^- h^- h^+ \geq 2\pi^0 \nu_\tau$ (ex. K^0)		$(5.14 \pm 0.34) \times 10^{-3}$	S=1.1
Γ_{75}	$h^- h^- h^+ 2\pi^0 \nu_\tau$		$(5.02 \pm 0.34) \times 10^{-3}$	S=1.1
Γ_{76}	$h^- h^- h^+ 2\pi^0 \nu_\tau$ (ex.K^0)		$(4.92 \pm 0.34) \times 10^{-3}$	S=1.1
Γ_{77}	$h^- h^- h^+ 2\pi^0 \nu_\tau$ (ex.K^0,ω,η)	[a]	$(9 \pm 4) \times 10^{-4}$	
Γ_{78}	$h^- h^- h^+ 3\pi^0 \nu_\tau$	[a]	$(2.2 \pm 0.5) \times 10^{-4}$	
Γ_{79}	$K^- h^+ h^- \geq 0$ neutrals ν_τ		$(6.79 \pm 0.35) \times 10^{-3}$	S=1.3
Γ_{80}	$K^- h^+ \pi^- \nu_\tau$ (ex.K^0)		$(4.86 \pm 0.32) \times 10^{-3}$	S=1.4
Γ_{81}	$K^- h^+ \pi^- \pi^0 \nu_\tau$ (ex.K^0)		$(8.5 \pm 1.2) \times 10^{-4}$	
Γ_{82}	$K^- \pi^+ \pi^- \geq 0$ neutrals ν_τ		$(5.2 \pm 0.4) \times 10^{-3}$	S=1.5
Γ_{83}	$K^- \pi^+ \pi^- \geq 0\pi^0 \nu_\tau$ (ex.K^0)		$(4.1 \pm 0.4) \times 10^{-3}$	S=1.5
Γ_{84}	$K^- \pi^+ \pi^- \nu_\tau$		$(3.9 \pm 0.4) \times 10^{-3}$	S=1.6
Γ_{85}	$K^- \pi^+ \pi^- \nu_\tau$ (ex.K^0)	[a]	$(3.33 \pm 0.35) \times 10^{-3}$	S=1.6
Γ_{86}	$K^- \rho^0 \nu_\tau \to K^- \pi^+ \pi^- \nu_\tau$		$(1.6 \pm 0.6) \times 10^{-3}$	
Γ_{87}	$K^- \pi^+ \pi^- \pi^0 \nu_\tau$		$(1.32 \pm 0.14) \times 10^{-3}$	

Γ_{88}	$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0)		$(7.9 \pm 1.2) \times 10^{-4}$	
Γ_{89}	$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0,η)	[a]	$(7.3 \pm 1.2) \times 10^{-4}$	
Γ_{90}	$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0,ω)		$(3.7 \pm 0.9) \times 10^{-4}$	
Γ_{91}	$K^-\pi^+K^- \geq 0$ neut. ν_τ		$< 9 \times 10^{-4}$	CL=95%
Γ_{92}	$K^-K^+\pi^- \geq 0$ neut. ν_τ		$(1.59 \pm 0.10) \times 10^{-3}$	S=1.4
Γ_{93}	$K^-K^+\pi^-\nu_\tau$	[a]	$(1.53 \pm 0.10) \times 10^{-3}$	S=1.4
Γ_{94}	$K^-K^+\pi^-\pi^0\nu_\tau$	[a]	$(6.1 \pm 2.0) \times 10^{-5}$	S=1.1
Γ_{95}	$K^-K^+K^- \geq 0$ neut. ν_τ		$< 2.1 \times 10^{-3}$	CL=95%
Γ_{96}	$K^-K^+K^-\nu_\tau$		$< 3.7 \times 10^{-5}$	CL=90%
Γ_{97}	$K^-K^+K^-\pi^0\nu_\tau$		$< 4.8 \times 10^{-6}$	CL=90%
Γ_{98}	$\pi^-K^+\pi^- \geq 0$ neut. ν_τ		$< 2.5 \times 10^{-3}$	CL=95%
Γ_{99}	$e^-e^-e^+\overline{\nu}_e\nu_\tau$		$(2.8 \pm 1.5) \times 10^{-5}$	
Γ_{100}	$\mu^-e^-e^+\overline{\nu}_\mu\nu_\tau$		$< 3.6 \times 10^{-5}$	CL=90%

Modes with five charged particles

Γ_{101}	$3h^-2h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^-\pi^+$) ("5-prong")		$(1.02 \pm 0.04) \times 10^{-3}$	S=1.1
Γ_{102}	$3h^-2h^+\nu_\tau$ (ex.K^0)	[a]	$(8.38 \pm 0.35) \times 10^{-4}$	S=1.1
Γ_{103}	$3h^-2h^+\pi^0\nu_\tau$ (ex.K^0)	[a]	$(1.78 \pm 0.27) \times 10^{-4}$	
Γ_{104}	$3h^-2h^+2\pi^0\nu_\tau$		$< 1.1 \times 10^{-4}$	CL=90%

Miscellaneous other allowed modes

Γ_{105}	$(5\pi)^-\nu_\tau$	$(7.6 \pm 0.5) \times 10^{-3}$	S=1.1
Γ_{106}	$4h^-3h^+ \geq 0$ neutrals ν_τ ("7-prong")	$< 3.0 \times 10^{-7}$	CL=90%
Γ_{107}	$4h^-3h^+\nu_\tau$	$< 4.3 \times 10^{-7}$	CL=90%
Γ_{108}	$4h^-3h^+\pi^0\nu_\tau$	$< 2.5 \times 10^{-7}$	CL=90%
Γ_{109}	$X^-(S{=}-1)\nu_\tau$	(2.95 ± 0.07) %	S=1.1
Γ_{110}	$K^*(892)^- \geq 0$ neutrals $\geq 0K^0_L\nu_\tau$	(1.42 ± 0.18) %	S=1.4
Γ_{111}	$K^*(892)^-\nu_\tau$	(1.29 ± 0.05) %	
Γ_{112}	$K^*(892)^0K^- \geq 0$ neutrals ν_τ	$(3.2 \pm 1.4) \times 10^{-3}$	
Γ_{113}	$K^*(892)^0K^-\nu_\tau$	$(2.1 \pm 0.4) \times 10^{-3}$	
Γ_{114}	$\overline{K}^*(892)^0\pi^- \geq 0$ neutrals ν_τ	$(3.8 \pm 1.7) \times 10^{-3}$	
Γ_{115}	$\overline{K}^*(892)^0\pi^-\nu_\tau$	$(2.2 \pm 0.5) \times 10^{-3}$	
Γ_{116}	$(\overline{K}^*(892)\pi)^-\nu_\tau \to \pi^-\overline{K}^0\pi^0\nu_\tau$	$(1.0 \pm 0.4) \times 10^{-3}$	
Γ_{117}	$K_1(1270)^-\nu_\tau$	$(4.7 \pm 1.1) \times 10^{-3}$	
Γ_{118}	$K_1(1400)^-\nu_\tau$	$(1.7 \pm 2.6) \times 10^{-3}$	S=1.7
Γ_{119}	$K^*(1410)^-\nu_\tau$	$(1.5 {}^{+1.4}_{-1.0}) \times 10^{-3}$	
Γ_{120}	$K^*_0(1430)^-\nu_\tau$	$< 5 \times 10^{-4}$	CL=95%
Γ_{121}	$K^*_2(1430)^-\nu_\tau$	$< 3 \times 10^{-3}$	CL=95%
Γ_{122}	$a_0(980)^- \geq 0$ neutrals ν_τ		

Γ_{123}	$\eta\pi^-\nu_\tau$		$< 1.4 \times 10^{-4}$	CL=95%
Γ_{124}	$\eta\pi^-\pi^0\nu_\tau$	[a]	$(1.77\pm0.24) \times 10^{-3}$	
Γ_{125}	$\eta\pi^-\pi^0\pi^0\nu_\tau$		$(1.5 \pm0.5) \times 10^{-4}$	
Γ_{126}	$\eta K^-\nu_\tau$	[a]	$(2.7 \pm0.6) \times 10^{-4}$	
Γ_{127}	$\eta K^*(892)^-\nu_\tau$		$(2.9 \pm0.9) \times 10^{-4}$	
Γ_{128}	$\eta K^-\pi^0\nu_\tau$		$(1.8 \pm0.9) \times 10^{-4}$	
Γ_{129}	$\eta\overline{K}^0\pi^-\nu_\tau$		$(2.2 \pm0.7) \times 10^{-4}$	
Γ_{130}	$\eta\pi^+\pi^-\pi^- \geq 0$ neutrals ν_τ		$< 3 \times 10^{-3}$	CL=90%
Γ_{131}	$\eta\pi^-\pi^+\pi^-\nu_\tau$		$(2.3 \pm0.5) \times 10^{-4}$	
Γ_{132}	$\eta a_1(1260)^-\nu_\tau \to \eta\pi^-\rho^0\nu_\tau$		$< 3.9 \times 10^{-4}$	CL=90%
Γ_{133}	$\eta\eta\pi^-\nu_\tau$		$< 1.1 \times 10^{-4}$	CL=95%
Γ_{134}	$\eta\eta\pi^-\pi^0\nu_\tau$		$< 2.0 \times 10^{-4}$	CL=95%
Γ_{135}	$\eta'(958)\pi^-\nu_\tau$		$< 7.4 \times 10^{-5}$	CL=90%
Γ_{136}	$\eta'(958)\pi^-\pi^0\nu_\tau$		$< 8.0 \times 10^{-5}$	CL=90%
Γ_{137}	$\phi\pi^-\nu_\tau$		$< 2.0 \times 10^{-4}$	CL=90%
Γ_{138}	$\phi K^-\nu_\tau$		$< 6.7 \times 10^{-5}$	CL=90%
Γ_{139}	$f_1(1285)\pi^-\nu_\tau$		$(4.1 \pm0.8) \times 10^{-4}$	
Γ_{140}	$f_1(1285)\pi^-\nu_\tau \to \eta\pi^-\pi^+\pi^-\nu_\tau$		$(1.3 \pm0.4) \times 10^{-4}$	
Γ_{141}	$\pi(1300)^-\nu_\tau \to (\rho\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau$		$< 1.0 \times 10^{-4}$	CL=90%
Γ_{142}	$\pi(1300)^-\nu_\tau \to ((\pi\pi)_{S-\text{wave}}\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau$		$< 1.9 \times 10^{-4}$	CL=90%
Γ_{143}	$h^-\omega \geq 0$ neutrals ν_τ		(2.39 ± 0.09) %	S=1.2
Γ_{144}	$h^-\omega\nu_\tau$	[a]	(1.99 ± 0.08) %	S=1.2
Γ_{145}	$K^-\omega\nu_\tau$		$(4.1 \pm0.9) \times 10^{-4}$	
Γ_{146}	$h^-\omega\pi^0\nu_\tau$	[a]	$(4.1 \pm0.4) \times 10^{-3}$	
Γ_{147}	$h^-\omega 2\pi^0\nu_\tau$		$(1.4 \pm0.5) \times 10^{-4}$	
Γ_{148}	$2h^-h^+\omega\nu_\tau$		$(1.20\pm0.22) \times 10^{-4}$	

Lepton Family number (*LF*), Lepton number (*L*), or Baryon number (*B*) violating modes

L means lepton number violation (*e.g.* $\tau^- \to e^+\pi^-\pi^-$). Following common usage, *LF* means lepton family violation *and not* lepton number violation (*e.g.* $\tau^- \to e^-\pi^+\pi^-$). *B* means baryon number violation.

Γ_{149}	$e^-\gamma$	*LF*	$< 1.1 \times 10^{-7}$	CL=90%
Γ_{150}	$\mu^-\gamma$	*LF*	$< 6.8 \times 10^{-8}$	CL=90%
Γ_{151}	$e^-\pi^0$	*LF*	$< 1.9 \times 10^{-7}$	CL=90%
Γ_{152}	$\mu^-\pi^0$	*LF*	$< 4.1 \times 10^{-7}$	CL=90%
Γ_{153}	$e^-K^0_S$	*LF*	$< 9.1 \times 10^{-7}$	CL=90%
Γ_{154}	$\mu^-K^0_S$	*LF*	$< 9.5 \times 10^{-7}$	CL=90%
Γ_{155}	$e^-\eta$	*LF*	$< 2.4 \times 10^{-7}$	CL=90%
Γ_{156}	$\mu^-\eta$	*LF*	$< 1.5 \times 10^{-7}$	CL=90%

Γ_{157}	$e^- \rho^0$	LF	$<$ 2.0	$\times 10^{-6}$	CL=90%
Γ_{158}	$\mu^- \rho^0$	LF	$<$ 6.3	$\times 10^{-6}$	CL=90%
Γ_{159}	$e^- K^*(892)^0$	LF	$<$ 5.1	$\times 10^{-6}$	CL=90%
Γ_{160}	$\mu^- K^*(892)^0$	LF	$<$ 7.5	$\times 10^{-6}$	CL=90%
Γ_{161}	$e^- \overline{K}^*(892)^0$	LF	$<$ 7.4	$\times 10^{-6}$	CL=90%
Γ_{162}	$\mu^- \overline{K}^*(892)^0$	LF	$<$ 7.5	$\times 10^{-6}$	CL=90%
Γ_{163}	$e^- \eta'(958)$	LF	$<$ 1.0	$\times 10^{-6}$	CL=90%
Γ_{164}	$\mu^- \eta'(958)$	LF	$<$ 4.7	$\times 10^{-7}$	CL=90%
Γ_{165}	$e^- \phi$	LF	$<$ 6.9	$\times 10^{-6}$	CL=90%
Γ_{166}	$\mu^- \phi$	LF	$<$ 7.0	$\times 10^{-6}$	CL=90%
Γ_{167}	$e^- e^+ e^-$	LF	$<$ 2.0	$\times 10^{-7}$	CL=90%
Γ_{168}	$e^- \mu^+ \mu^-$	LF	$<$ 2.0	$\times 10^{-7}$	CL=90%
Γ_{169}	$e^+ \mu^- \mu^-$	LF	$<$ 1.3	$\times 10^{-7}$	CL=90%
Γ_{170}	$\mu^- e^+ e^-$	LF	$<$ 1.9	$\times 10^{-7}$	CL=90%
Γ_{171}	$\mu^+ e^- e^-$	LF	$<$ 1.1	$\times 10^{-7}$	CL=90%
Γ_{172}	$\mu^- \mu^+ \mu^-$	LF	$<$ 1.9	$\times 10^{-7}$	CL=90%
Γ_{173}	$e^- \pi^+ \pi^-$	LF	$<$ 1.2	$\times 10^{-7}$	CL=90%
Γ_{174}	$e^+ \pi^- \pi^-$	L	$<$ 2.7	$\times 10^{-7}$	CL=90%
Γ_{175}	$\mu^- \pi^+ \pi^-$	LF	$<$ 2.9	$\times 10^{-7}$	CL=90%
Γ_{176}	$\mu^+ \pi^- \pi^-$	L	$<$ 7	$\times 10^{-8}$	CL=90%
Γ_{177}	$e^- \pi^+ K^-$	LF	$<$ 3.2	$\times 10^{-7}$	CL=90%
Γ_{178}	$e^- \pi^- K^+$	LF	$<$ 1.7	$\times 10^{-7}$	CL=90%
Γ_{179}	$e^+ \pi^- K^-$	L	$<$ 1.8	$\times 10^{-7}$	CL=90%
Γ_{180}	$e^- K^0_S K^0_S$	LF	$<$ 2.2	$\times 10^{-6}$	CL=90%
Γ_{181}	$e^- K^+ K^-$	LF	$<$ 1.4	$\times 10^{-7}$	CL=90%
Γ_{182}	$e^+ K^- K^-$	L	$<$ 1.5	$\times 10^{-7}$	CL=90%
Γ_{183}	$\mu^- \pi^+ K^-$	LF	$<$ 2.6	$\times 10^{-7}$	CL=90%
Γ_{184}	$\mu^- \pi^- K^+$	LF	$<$ 3.2	$\times 10^{-7}$	CL=90%
Γ_{185}	$\mu^+ \pi^- K^-$	L	$<$ 2.2	$\times 10^{-7}$	CL=90%
Γ_{186}	$\mu^- K^0_S K^0_S$	LF	$<$ 3.4	$\times 10^{-6}$	CL=90%
Γ_{187}	$\mu^- K^+ K^-$	LF	$<$ 2.5	$\times 10^{-7}$	CL=90%
Γ_{188}	$\mu^+ K^- K^-$	L	$<$ 4.8	$\times 10^{-7}$	CL=90%
Γ_{189}	$e^- \pi^0 \pi^0$	LF	$<$ 6.5	$\times 10^{-6}$	CL=90%
Γ_{190}	$\mu^- \pi^0 \pi^0$	LF	$<$ 1.4	$\times 10^{-5}$	CL=90%
Γ_{191}	$e^- \eta \eta$	LF	$<$ 3.5	$\times 10^{-5}$	CL=90%
Γ_{192}	$\mu^- \eta \eta$	LF	$<$ 6.0	$\times 10^{-5}$	CL=90%
Γ_{193}	$e^- \pi^0 \eta$	LF	$<$ 2.4	$\times 10^{-5}$	CL=90%
Γ_{194}	$\mu^- \pi^0 \eta$	LF	$<$ 2.2	$\times 10^{-5}$	CL=90%
Γ_{195}	$\overline{p} \gamma$	L,B	$<$ 3.5	$\times 10^{-6}$	CL=90%
Γ_{196}	$\overline{p} \pi^0$	L,B	$<$ 1.5	$\times 10^{-5}$	CL=90%
Γ_{197}	$\overline{p} 2\pi^0$	L,B	$<$ 3.3	$\times 10^{-5}$	CL=90%
Γ_{198}	$\overline{p} \eta$	L,B	$<$ 8.9	$\times 10^{-6}$	CL=90%
Γ_{199}	$\overline{p} \pi^0 \eta$	L,B	$<$ 2.7	$\times 10^{-5}$	CL=90%
Γ_{200}	$\Lambda \pi^-$	L,B	$<$ 7.2	$\times 10^{-8}$	CL=90%

Γ_{201}	$\overline{\Lambda}\pi^-$	*L,B*	< 1.4	$\times 10^{-7}$	CL=90%
Γ_{202}	e^- light boson	*LF*	< 2.7	$\times 10^{-3}$	CL=95%
Γ_{203}	μ^- light boson	*LF*	< 5	$\times 10^{-3}$	CL=95%

[*a*] Basis mode for the τ.

[*b*] See the Particle Listings below for the energy limits used in this measurement.

CONSTRAINED FIT INFORMATION

An overall fit to 64 branching ratios uses 125 measurements and one constraint to determine 31 parameters. The overall fit has a $\chi^2 = 77.5$ for 95 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle \delta x_i \delta x_j \right\rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	−14									
x_9	−3	−5								
x_{10}	0	2	−22							
x_{14}	−13	−12	−16	0						
x_{16}	0	1	−2	−3	−9					
x_{20}	−5	−10	−10	−5	−54	−4				
x_{23}	0	1	−1	−3	0	−20	−7			
x_{27}	−4	−5	−10	−1	−5	0	−14	−1		
x_{28}	0	0	0	−2	2	−18	−4	−15	−10	
x_{30}	−3	−3	−12	1	−12	−1	15	−1	−37	1
x_{35}	−6	−4	−7	−2	0	−1	−12	−1	−5	0
x_{37}	−2	−2	−1	−1	1	−11	−1	−9	0	−8
x_{40}	−5	−3	−6	−2	0	2	−10	1	−7	1
x_{42}	−1	−1	0	−2	1	−14	1	−11	0	−11
x_{47}	0	0	−1	0	0	0	−1	0	0	0
x_{48}	−3	−2	−4	−1	0	0	−7	0	−3	0
x_{62}	−5	−2	3	0	8	1	−35	0	−22	1
x_{70}	−3	−1	−6	4	−4	3	−7	1	−5	1
x_{77}	1	−1	−2	−1	−6	0	8	−1	6	−1
x_{78}	0	0	0	0	1	0	−1	0	0	0
x_{85}	1	2	−2	−2	2	−2	−7	−2	−2	−2
x_{89}	1	1	0	−1	2	−1	−2	0	−1	0
x_{93}	−1	−1	1	1	1	1	−3	0	−3	1
x_{94}	0	0	0	0	0	0	0	0	0	0
x_{102}	0	−1	1	−2	−3	−1	6	0	4	0
x_{103}	−1	−1	−1	0	−2	0	2	0	1	0
x_{124}	−2	−1	−2	−1	1	−1	−7	−1	−1	−1
x_{126}	0	0	0	0	0	−3	−1	−3	−1	−3
x_{144}	−3	−2	−4	1	−2	0	−6	0	−4	0
x_{146}	−1	−2	−4	−1	−7	−1	7	−1	7	−2
	x_3	x_5	x_9	x_{10}	x_{14}	x_{16}	x_{20}	x_{23}	x_{27}	x_{28}

	x_{30}	x_{35}	x_{37}	x_{40}	x_{42}	x_{47}	x_{48}	x_{62}	x_{70}	x_{77}
x_{35}	−1									
x_{37}	0	−5								
x_{40}	0	−13	−1							
x_{42}	0	−2	−16	−19						
x_{47}	0	−2	−1	−2	−1					
x_{48}	−1	−18	−5	−14	−4	−3				
x_{62}	−11	2	0	2	0	0	1			
x_{70}	1	6	1	5	0	0	3	−9		
x_{77}	5	−1	0	−1	0	0	−1	−7	−9	
x_{78}	−1	−1	0	−1	0	0	0	−1	−1	−1
x_{85}	−1	−5	0	−4	0	0	−3	−13	−1	0
x_{89}	−1	−2	0	−2	0	0	−1	−3	−7	−1
x_{93}	−1	1	0	1	0	0	1	17	−1	−1
x_{94}	0	0	0	0	0	0	0	0	−1	0
x_{102}	1	−2	0	−2	0	0	−1	−6	−3	2
x_{103}	−1	0	0	0	0	0	0	−2	0	1
x_{124}	−7	−3	0	−3	0	0	−2	1	2	−16
x_{126}	0	0	−2	0	−2	0	0	0	0	0
x_{144}	0	0	0	0	0	0	0	−5	−65	−4
x_{146}	4	−4	0	−3	0	0	−2	−8	−12	−58

	x_{78}	x_{85}	x_{89}	x_{93}	x_{94}	x_{102}	x_{103}	x_{124}	x_{126}	x_{144}
x_{85}	−1									
x_{89}	−1	−3								
x_{93}	0	−47	0							
x_{94}	0	0	−2	0						
x_{102}	0	−2	0	0	0					
x_{103}	0	−1	0	0	0	−5				
x_{124}	0	−3	−1	1	0	−1	0			
x_{126}	0	0	−12	0	0	0	0	0		
x_{144}	−1	−2	2	0	0	−2	0	0	0	
x_{146}	−1	−2	−1	−1	0	2	1	−2	0	−6

τ BRANCHING FRACTIONS

Revised April 2006 by K.G. Hayes (Hillsdale College).

The B factories have led to a resurgence in experimental publications on the τ. Since the previous edition of this *Review*, there have been 19 published papers that have contributed measurements to the τ Listings, including 6 each from the BaBar and BELLE collaborations. Nine of these papers have provided new upper limits on the branching fractions for neutrinoless τ-decay modes. Of the 55 neutrionless τ- decay modes in the τ Listings, 4 are new and 26 have had improved limits set. The upper limits have been reduced by factors that range between 7 and 64, and the average reduction factor is 24.

The constrained fit to τ branching fractions: The Lepton Summary Table and the List of τ-Decay Modes contain branching fractions for 114 conventional τ-decay modes and upper limits on the branching fractions for 30 other conventional τ-decay modes. Of the 114 modes with branching fractions, 82 are derived from a constrained fit to τ branching fraction data. The goal of the constrained fit is to make optimal use of the experimental data to determine τ branching fractions. For example, the branching fractions for the decay modes $\tau^- \to \pi^-\pi^+\pi^-\nu_\tau$ and $\tau^- \to \pi^-\pi^+\pi^-\pi^0\nu_\tau$ are determined mostly from experimental measurements of the branching fractions for $\tau^- \to h^-h^-h^+\nu_\tau$ and $\tau^- \to h^-h^-h^+\pi^0\nu_\tau$ and recent measurements of exclusive branching fractions for 3-prong modes containing charged kaons and 0 or 1 π^0's.

Branching fractions from the constrained fit are derived from a set of basis modes. The basis modes form an exclusive set whose branching fractions are constrained to sum exactly to one. The set of selected basis modes expands as branching fraction measurements for new τ-decay modes are published. The number of basis modes has expanded from 12 in the year 1994 fit to 31 in the 2002, 2004, and 2006 fits. The 31 basis modes selected for the 2006 fit are listed in Table 1. See the 1996 edition of this *Review* [1] for a complete description of our notation for naming τ-decay modes and the selection of the basis modes. For each edition since the 1996 edition, the changes in the selected basis modes from the previous edition are described in the τ Branching Fractions Review. Figure 1 illustrates the basis mode branching fractions from the 2006 fit.

Table 1: Basis modes for the 2006 fit to τ branching fraction data.

$e^-\overline{\nu}_e\nu_\tau$	$K^-K^0\pi^0\nu_\tau$
$\mu^-\overline{\nu}_\mu\nu_\tau$	$\pi^-\pi^+\pi^-\nu_\tau$ (ex. K^0,ω)
$\pi^-\nu_\tau$	$\pi^-\pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0,ω)
$\pi^-\pi^0\nu_\tau$	$K^-\pi^+\pi^-\nu_\tau$ (ex. K^0)
$\pi^-2\pi^0\nu_\tau$ (ex. K^0)	$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0,η)
$\pi^-3\pi^0\nu_\tau$ (ex. K^0)	$K^-K^+\pi^-\nu_\tau$
$h^-4\pi^0\nu_\tau$ (ex. K^0,η)	$K^-K^+\pi^-\pi^0\nu_\tau$
$K^-\nu_\tau$	$h^-h^-h^+2\pi^0\nu_\tau$ (ex. K^0,ω,η)
$K^-\pi^0\nu_\tau$	$h^-h^-h^+3\pi^0\nu_\tau$
$K^-2\pi^0\nu_\tau$ (ex. K^0)	$3h^-2h^+\nu_\tau$ (ex. K^0)
$K^-3\pi^0\nu_\tau$ (ex. K^0,η)	$3h^-2h^+\pi^0\nu_\tau$ (ex. K^0)
$\pi^-\overline{K}^0\nu_\tau$	$h^-\omega\nu_\tau$
$\pi^-\overline{K}^0\pi^0\nu_\tau$	$h^-\omega\pi^0\nu_\tau$
$\pi^-K^0_SK^0_S\nu_\tau$	$\eta\pi^-\pi^0\nu_\tau$
$\pi^-K^0_SK^0_L\nu_\tau$	$\eta K^-\nu_\tau$
$K^-K^0\nu_\tau$	

In selecting the basis modes, assumptions and choices must be made. For example, we assume the decays $\tau^- \to \pi^-K^+\pi^- \geq 0\pi^0\nu_\tau$ and $\tau^- \to \pi^+K^-K^- \geq 0\pi^0\nu\tau$ have negligible branching fractions. This is consistent with standard model predictions for τ decay, although the experimental limits for these branching fractions are not very stringent. The 95% confidence level upper limits for these branching fractions in the current Listings are $\mathrm{B}(\tau^- \to \pi^- K^+ \pi^- \geq 0\pi^0 \nu_\tau) < 0.25\%$ and $\mathrm{B}(\tau^- \to \pi^+ K^- K^- \geq 0\pi^0 \nu_\tau) < 0.09\%$, values not so different from measured branching fractions for allowed 3-prong modes containing charged kaons. Although our usual goal is to impose as few theoretical constraints as possible so that the world averages and fit results can be used to test the theoretical constraints (*i.e.*, we do not make use of the theoretical constraint from lepton universality on the ratio of the τ-leptonic branching fractions $\mathrm{B}(\tau^- \to \mu^- \overline{\nu}_\mu \nu_\tau)/\ \mathrm{B}(\tau^- \to e^- \overline{\nu}_e \nu_\tau) = 0.9726$), the experimental challenge to identify charged prongs in 3-prong τ decays is sufficiently difficult that experimenters have been forced to make these assumptions when measuring the branching fractions of the allowed decays. We are constrained by the assumptions made by the experimenters.

There are several recently measured modes with small but well-measured ($>$ 2.5 sigma from zero) branching fractions [2] which cannot be expressed in terms of the selected basis modes and are therefore left out of the fit:

$$\begin{aligned}
\mathrm{B}(\tau^- \to \pi^- K^0_S K^0_L \pi^0 \nu_\tau) &= (3.1 \pm 1.2) \times 10^{-4} \\
\mathrm{B}(\tau^- \to h^- \omega \pi^0 \pi^0 \nu_\tau) &= (1.4 \pm 0.5) \times 10^{-4} \\
\mathrm{B}(\tau^- \to 2h^- h^+ \omega \nu_\tau) &= (1.20 \pm 0.22) \times 10^{-4}
\end{aligned}$$

plus the $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\gamma$ components of the branching fractions

$$\begin{aligned}
\mathrm{B}(\tau^- \to \eta \pi^- \pi^+ \pi^- \nu_\tau) &= (2.3 \pm 0.5) \times 10^{-4}\ , \\
\mathrm{B}(\tau^- \to \eta \pi^- \pi^0 \pi^0 \nu_\tau) &= (1.5 \pm 0.5) \times 10^{-4}\ , \\
\mathrm{B}(\tau^- \to \eta \overline{K}^0 \pi^- \nu_\tau) &= (2.2 \pm 0.7) \times 10^{-4}\ .
\end{aligned}$$

The sum of these excluded branching fractions is $(0.08 \pm 0.01)\%$. This is near our goal of 0.1% for the internal consistency of the τ Listings for this edition, and thus for simplicity we do

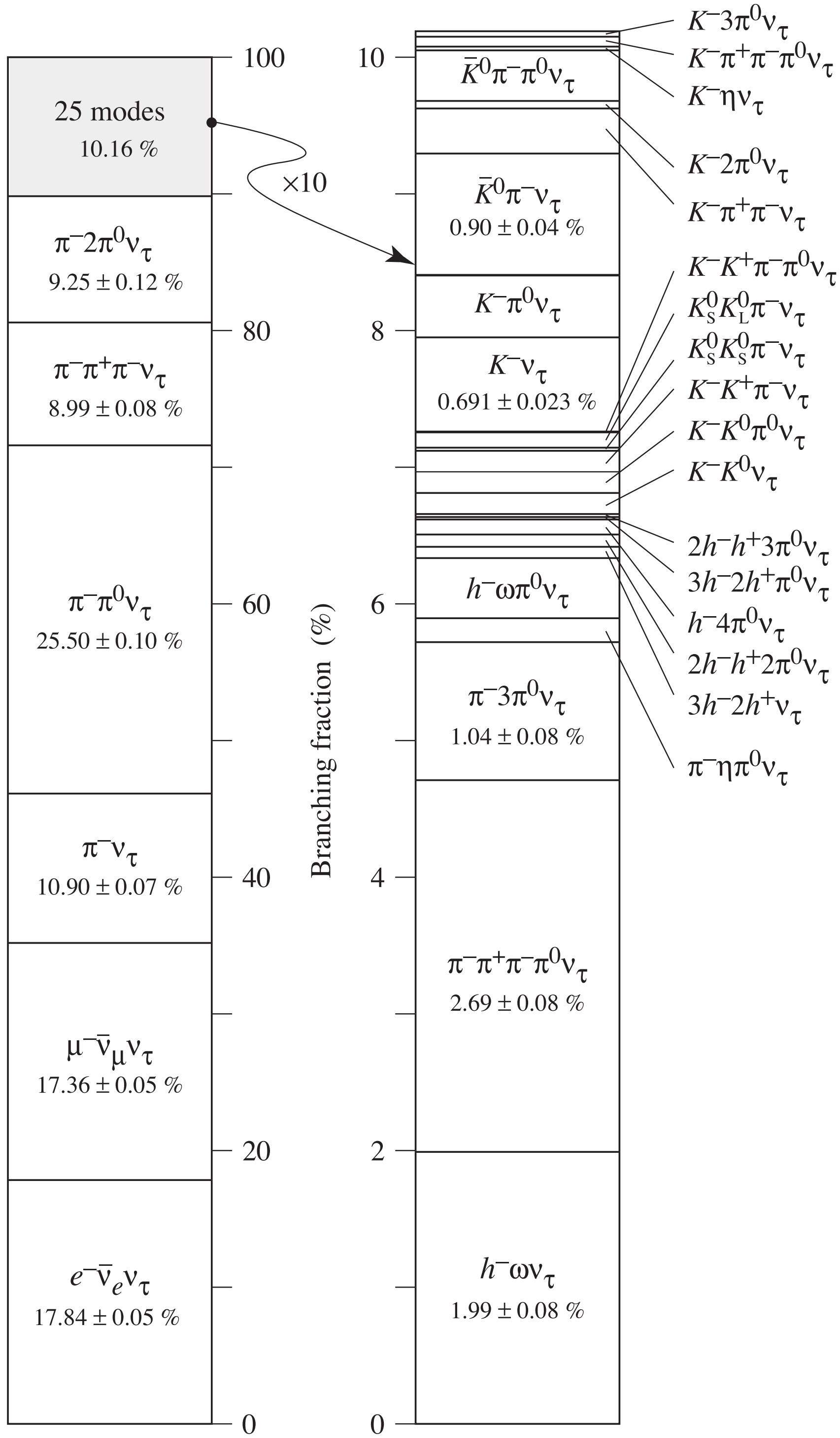

Figure 1: Basis mode branching fractions of the τ. Six modes account for 90% of the decays, 25 modes account for the last 10%. The list of excluded intermediate states for each basis mode has been suppressed.

not include these small branching fraction decay modes in the basis set.

Beginning with the 2002 edition, the fit algorithm has been improved to allow for correlations between branching fraction measurements used in the fit. If only a few measurements are correlated, the correlation coefficients are listed in the footnote for each measurement. If a large number of measurements are correlated, then the full correlation matrix is listed in the footnote to the measurement that first appears in the τ Listings. Footnotes to the other measurements refer to the first measurement. For example, the large correlation matrices for the branching fraction measurements contained in Refs. [3,4] are listed in Footnotes 48 and 66 respectively. Sometimes experimental papers contain correlation coefficients between measurements using only statistical errors without including systematic errors. We usually cannot make use of these correlation coefficients.

The constrained fit has a χ^2 of 77.5 for 95 degrees of freedom. Two new branching fraction measurements caused significant changes in two of the 2006 basis mode branching fractions from their 2004 values.

i) B($\tau^- \rightarrow K^- K^+ \pi^- \pi^0 \nu_\tau$ changed from $(4.2 \pm 1.6) \times 10^{-4}$ to $(0.61 \pm 0.20) \times 10^{-4}$ due to a precise new measurement by the CLEO Collaboration [5], which has 99% of the weight in the world average, and is significantly lower than previous measurements.

ii) The ALEPH Collaboration has published [3] a complete set of branching fraction measurements which supersede the results contained in earlier publications [6–8]. Differences between these new and old measurements are primarily responsible for a significant change in the basis mode branching fraction $\mathrm{B}(\tau^- \to \pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0, ω)) from $(2.51 \pm 0.09)\%$ to $(2.69 \pm 0.08)\%$.

These changes in the basis mode values have caused other significant changes in some of the 51 branching fractions which are determined from combinations of the basis modes. For example, the four branching fractions $\mathrm{B}(\tau^- \to h^-h^-h^+\nu_\tau)$, $\mathrm{B}(\tau^- \to h^-h^-h^+\nu_\tau$ (ex. K^0)), $\mathrm{B}(\tau^- \to \pi^-\pi^+\pi^-\pi^0\nu_\tau)$ and $\mathrm{B}(\tau^- \to \pi^-\pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0)) have all increased by between 2.2 and 2.4 σ from their 2004 values. Due to the constraint on the sum of basis mode branching fractions, an increase in one basis mode branching fraction requires other basis mode branching fractions to decrease. The most significant decrease is for the basis mode branching fraction $\mathrm{B}(\tau^- \to \pi^-\pi^+\pi^-\nu_\tau$ (ex. K^0, ω)), which changed from $(9.12 \pm 0.10)\%$ to $(8.99 \pm 0.08)\%$. There are similar decreases in the fit values for other non-basis modes that are primarily determined by this mode.

Overconsistency of Leptonic Branching Fraction Measurements: To minimize the effects of older experiments which often have larger systematic errors and sometimes make assumptions that have later been shown to be invalid, we exclude old measurements in decay modes which contain at least several newer data of much higher precision. As a rule, we exclude those experiments with large errors which together would contribute no more than 5% of the weight in the average. This procedure leaves five measurements for $\mathrm{B}_e \equiv \mathrm{B}(\tau^- \to e^-\overline{\nu}_e\nu_\tau)$ and five measurements for $\mathrm{B}_\mu \equiv \mathrm{B}(\tau^- \to \mu^-\overline{\nu}_\mu\nu_\tau)$. For both B_e and B_μ, the selected measurements are considerably more consistent with each other than should be expected from the quoted errors on the individual measurements. The χ^2 from the calculation of the average of the selected measurements is 0.34

for B_e and 0.08 for B_μ. Assuming normal errors, the probability of a smaller χ^2 is 1.3% for B_e and 0.08% for B_μ.

References

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τ^- BRANCHING RATIOS

$\Gamma\big(\text{particle}^- \geq 0 \text{ neutrals } \geq 0K^0\nu_\tau\,(\text{“1-prong”})\big)/\Gamma_{\text{total}}$ $\qquad\Gamma_1/\Gamma$

$\Gamma_1/\Gamma = (\Gamma_3+\Gamma_5+\Gamma_9+\Gamma_{10}+\Gamma_{14}+\Gamma_{16}+\Gamma_{20}+\Gamma_{23}+\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+\Gamma_{35}+\Gamma_{37}+\Gamma_{40}+\Gamma_{42}+2\Gamma_{47}+\Gamma_{48}+0.708\Gamma_{124}+0.715\Gamma_{126}+0.09\Gamma_{144}+0.09\Gamma_{146})/\Gamma$

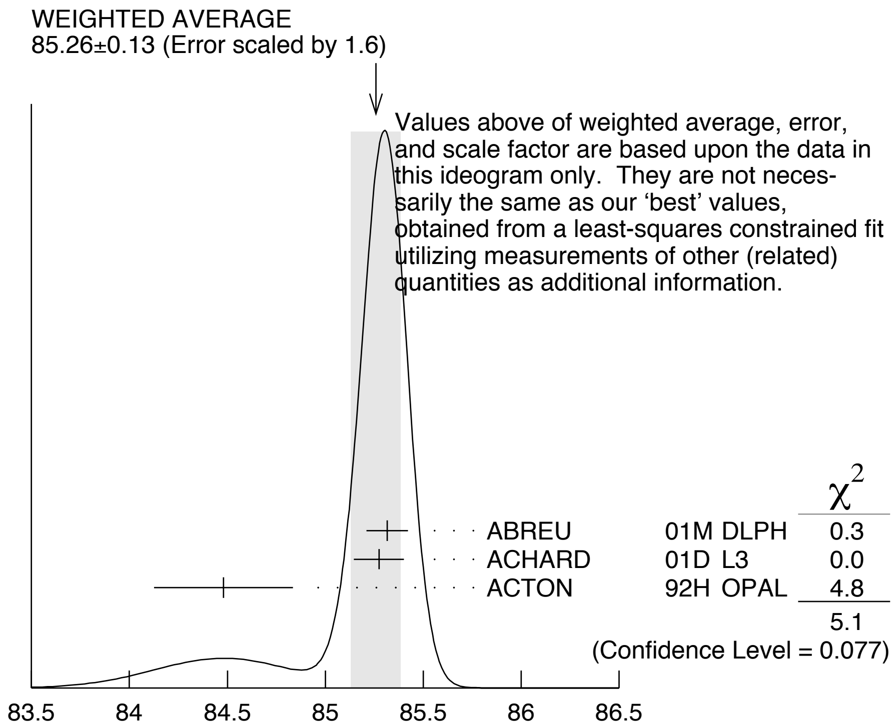
The charged particle here can be e, μ, or hadron. In many analyses, the sum of the topological branching fractions (1, 3, and 5 prongs) is constrained to be unity. Since the 5-prong fraction is very small, the measured 1-prong and 3-prong fractions are highly correlated and cannot be treated as independent quantities in our overall fit. We arbitrarily choose to use the 3-prong fraction in our fit, and leave the 1-prong fraction out. We do, however, use these 1-prong measurements in our average below. The measurements used only for the average are marked “avg,” whereas “f&a” marks a result used for the fit and the average.

VALUE (%)		*EVTS*	*DOCUMENT ID*	*TECN*	*COMMENT*
85.33 ±0.08 OUR FIT Error includes scale factor of 1.4.					
85.26 ±0.13 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.					
85.316±0.093±0.049	avg	78k	[32] ABREU	01M DLPH	1992–1995 LEP runs
85.274±0.105±0.073	avg		[33] ACHARD	01D L3	1992–1995 LEP runs
84.48 ±0.27 ±0.23	avg		ACTON	92H OPAL	1990–1991 LEP runs

• • • We do not use the following data for averages, fits, limits, etc. • • •

85.45 $^{+0.69}_{-0.73}$ ± 0.65		DECAMP	92C ALEP	Repl. by SCHAEL 05C

[32] The correlation coefficients between this measurement and the ABREU 01M measurements of B($\tau \to$ 3-prong) and B($\tau \to$ 5-prong) are -0.98 and -0.08 respectively.
[33] The correlation coefficients between this measurement and the ACHARD 01D measurements of B($\tau \to$ "3-prong") and B($\tau \to$ "5-prong") are -0.978 and -0.082 respectively.



$\Gamma\big(\text{particle}^- \geq 0 \text{ neutrals } \geq 0K^0 \nu_\tau (\text{"1-prong"})\big)/\Gamma_{\text{total}}$

$\Gamma\big(\text{particle}^- \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau\big)/\Gamma_{\text{total}}$ Γ_2/Γ

$\Gamma_2/\Gamma = (\Gamma_3+\Gamma_5+\Gamma_9+\Gamma_{10}+\Gamma_{14}+\Gamma_{16}+\Gamma_{20}+\Gamma_{23}+\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.6569\Gamma_{35}+ 0.6569\Gamma_{37}+0.6569\Gamma_{40}+0.6569\Gamma_{42}+1.0985\Gamma_{47}+0.3139\Gamma_{48}+0.708\Gamma_{124}+ 0.715\Gamma_{126}+0.09\Gamma_{144}+0.09\Gamma_{146})/\Gamma$

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
84.69±0.09 OUR FIT	Error includes scale factor of 1.4.					
85.1 ±0.4 OUR AVERAGE						
85.6 ±0.6 ±0.3	avg	3300	[34] ADEVA	91F	L3	E^{ee}_{cm}= 88.3–94.3 GeV
84.9 ±0.4 ±0.3	avg		BEHREND	89B	CELL	E^{ee}_{cm}= 14–47 GeV
84.7 ±0.8 ±0.6	avg		[35] AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
86.4 ±0.3 ±0.3			ABACHI	89B	HRS	E^{ee}_{cm}= 29 GeV
87.1 ±1.0 ±0.7			[36] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
87.2 ±0.5 ±0.8			SCHMIDKE	86	MRK2	E^{ee}_{cm}= 29 GeV
84.7 ±1.1 $^{+1.6}_{-1.3}$		169	[37] ALTHOFF	85	TASS	E^{ee}_{cm}= 34.5 GeV
86.1 ±0.5 ±0.9			BARTEL	85F	JADE	E^{ee}_{cm}= 34.6 GeV
87.8 ±1.3 ±3.9			[38] BERGER	85	PLUT	E^{ee}_{cm}= 34.6 GeV
86.7 ±0.3 ±0.6			FERNANDEZ	85	MAC	E^{ee}_{cm}= 29 GeV

[34] Not independent of ADEVA 91F $\Gamma(h^- h^- h^+ \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau)/\Gamma_{\text{total}}$ value.

[35] Not independent of AIHARA 87B $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma_{\text{total}}$, $\Gamma(e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$, and $\Gamma(h^- \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau)/\Gamma_{\text{total}}$ values.

[36] Not independent of SCHMIDKE 86 value (also not independent of BURCHAT 87 value for $\Gamma(h^- h^- h^+ \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau)/\Gamma_{\text{total}}$.

[37] Not independent of ALTHOFF 85 $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma_{\text{total}}$, $\Gamma(e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$, $\Gamma(h^- \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau)/\Gamma_{\text{total}}$, and $\Gamma(h^- h^- h^+ \geq 0 \text{ neutrals } \geq 0K^0_L \nu_\tau)/\Gamma_{\text{total}}$ values.

[38] Not independent of (1-prong + $0\pi^0$) and (1-prong + $\geq 1\pi^0$) values.

$\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma_{\text{total}}$ Γ_3/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

To minimize the effect of experiments with large systematic errors, we exclude experiments which together would contribute 5% of the weight in the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
17.36 ±0.05 OUR FIT						
17.33 ±0.05 OUR AVERAGE						
17.319±0.070±0.032	f&a	54k	[39] SCHAEL	05C	ALEP	1991-1995 LEP runs
17.34 ±0.09 ±0.06	f&a	31.4k	ABBIENDI	03	OPAL	1990–1995 LEP runs
17.342±0.110±0.067	f&a	21.5k	[40] ACCIARRI	01F	L3	1991–1995 LEP runs
17.325±0.095±0.077	f&a	27.7k	ABREU	99X	DLPH	1991–1995 LEP runs
17.37 ±0.08 ±0.18	avg		[41] ANASTASSOV	97	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
17.31 ±0.11 ±0.05		20.7k	BUSKULIC	96C	ALEP	Repl. by SCHAEL 05C
17.02 ±0.19 ±0.24		6586	ABREU	95T	DLPH	Repl.. by ABREU 99X
17.36 ±0.27		7941	AKERS	95I	OPAL	Repl. by ABBIENDI 03
17.6 ±0.4 ±0.4		2148	ADRIANI	93M	L3	Repl. by ACCIARRI 01F
17.4 ±0.3 ±0.5			[42] ALBRECHT	93G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
17.35 ±0.41 ±0.37			DECAMP	92C	ALEP	1989–1990 LEP runs
17.7 ±0.8 ±0.4		568	BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
17.4 ±1.0		2197	ADEVA	88	MRKJ	E^{ee}_{cm}= 14–16 GeV
17.7 ±1.2 ±0.7			AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV
18.3 ±0.9 ±0.8			BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
18.6 ±0.8 ±0.7		558	[43] BARTEL	86D	JADE	E^{ee}_{cm}= 34.6 GeV
12.9 ±1.7 $^{+0.7}_{-0.5}$			ALTHOFF	85	TASS	E^{ee}_{cm}= 34.5 GeV
18.0 ±0.9 ±0.5		473	[43] ASH	85B	MAC	E^{ee}_{cm}= 29 GeV
18.0 ±1.0 ±0.6			[44] BALTRUSAIT...	85	MRK3	E^{ee}_{cm}= 3.77 GeV
19.4 ±1.6 ±1.7		153	BERGER	85	PLUT	E^{ee}_{cm}= 34.6 GeV
17.6 ±2.6 ±2.1		47	BEHREND	83C	CELL	E^{ee}_{cm}= 34 GeV
17.8 ±2.0 ±1.8			BERGER	81B	PLUT	E^{ee}_{cm}= 9–32 GeV

[39] See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

[40] The correlation coefficient between this measurement and the ACCIARRI 01F measurement of $B(\tau^- \to e^- \overline{\nu}_e \nu_\tau)$ is 0.08.

[41] The correlation coefficients between this measurement and the ANASTASSOV 97 measurements of $B(e\overline{\nu}_e \nu_\tau)$, $B(\mu\overline{\nu}_\mu \nu_\tau)/B(e\overline{\nu}_e \nu_\tau)$, $B(h^- \nu_\tau)$, and $B(h^- \nu_\tau)/B(e\overline{\nu}_e \nu_\tau)$ are 0.50, 0.58, 0.50, and 0.08 respectively.

[42] Not independent of ALBRECHT 92D $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma(e^- \overline{\nu}_e \nu_\tau)$ and ALBRECHT 93G $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau) \times \Gamma(e^- \overline{\nu}_e \nu_\tau)/\Gamma^2_{\text{total}}$ values.

[43] Modified using $B(e^- \overline{\nu}_e \nu_\tau)$/B("1 prong") and B("1 prong") ,= 0.855.

[44] Error correlated with BALTRUSAITIS 85 $e\nu\overline{\nu}$ value.

$\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau \gamma)/\Gamma_{\text{total}}$ — Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.361±0.016±0.035		[45] BERGFELD	00	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.30 ±0.04 ±0.05	116	[46] ALEXANDER	96S	OPAL	1991–1994 LEP runs
0.23 ±0.10	10	[47] WU	90	MRK2	E^{ee}_{cm}= 29 GeV

[45] BERGFELD 00 impose requirements on detected γ's corresponding to a τ-rest-frame energy cutoff $E^*_\gamma > 10$ MeV. For $E^*_\gamma > 20$ MeV, they quote $(3.04 \pm 0.14 \pm 0.30) \times 10^{-3}$.

[46] ALEXANDER 96S impose requirements on detected γ's corresponding to a τ-rest-frame energy cutoff E_γ >20 MeV.

[47] WU 90 reports $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau \gamma)/\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau) = 0.013 \pm 0.006$, which is converted to $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau \gamma)/\Gamma_{\text{total}}$ using $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau \gamma)/\Gamma_{\text{total}} = 17.35\%$. Requirements on detected γ's correspond to a τ rest frame energy cutoff E_γ > 37 MeV.

$\Gamma(e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$ — Γ_5/Γ

To minimize the effect of experiments with large systematic errors, we exclude experiments which together would contribute 5% of the weight in the average.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
17.84 ±0.05 OUR FIT					
17.82 ±0.05 OUR AVERAGE					
17.837±0.072±0.036	56k	[48] SCHAEL	05C	ALEP	1991-1995 LEP runs
17.806±0.104±0.076	24.7k	[49] ACCIARRI	01F	L3	1991–1995 LEP runs
17.81 ±0.09 ±0.06	33.1k	ABBIENDI	99H	OPAL	1991–1995 LEP runs
17.877±0.109±0.110	23.3k	ABREU	99X	DLPH	1991–1995 LEP runs
17.76 ±0.06 ±0.17		[50] ANASTASSOV	97	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17.78 ±0.10 ±0.09	25.3k	ALEXANDER	96D	OPAL	Repl. by ABBIENDI 99H
17.79 ±0.12 ±0.06	20.6k	BUSKULIC	96C	ALEP	Repl. by SCHAEL 05C
17.51 ±0.23 ±0.31	5059	ABREU	95T	DLPH	Repl.. by ABREU 99X
17.9 ±0.4 ±0.4	2892	ADRIANI	93M	L3	Repl. by ACCIARRI 01F
17.5 ±0.3 ±0.5		[51] ALBRECHT	93G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
17.97 ±0.14 ±0.23	3970	AKERIB	92	CLEO	Repl. by ANASTASSOV 97
19.1 ±0.4 ±0.6	2960	[52] AMMAR	92	CLEO	E^{ee}_{cm}= 10.5–10.9 GeV
18.09 ±0.45 ±0.45		DECAMP	92C	ALEP	Repl. by SCHAEL 05C
17.0 ±0.5 ±0.6	1.7k	ABACHI	90	HRS	E^{ee}_{cm}= 29 GeV
18.4 ±0.8 ±0.4	644	BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV

16.3	±0.3	±3.2		JANSSEN	89	CBAL	E^{ee}_{cm}= 9.4–10.6 GeV
18.4	±1.2	±1.0		AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV
19.1	±0.8	±1.1		BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
16.8	±0.7	±0.9	515	[52] BARTEL	86D	JADE	E^{ee}_{cm}= 34.6 GeV
20.4	±3.0	$^{+1.4}_{-0.9}$		ALTHOFF	85	TASS	E^{ee}_{cm}= 34.5 GeV
17.8	±0.9	±0.6	390	[52] ASH	85B	MAC	E^{ee}_{cm}= 29 GeV
18.2	±0.7	±0.5		[53] BALTRUSAIT...	85	MRK3	E^{ee}_{cm}= 3.77 GeV
13.0	±1.9	±2.9		BERGER	85	PLUT	E^{ee}_{cm}= 34.6 GeV
18.3	±2.4	±1.9	60	BEHREND	83C	CELL	E^{ee}_{cm}= 34 GeV
16.0	±1.3		459	[54] BACINO	78B	DLCO	E^{ee}_{cm}= 3.1–7.4 GeV

[48] Correlation matrix for SCHAEL 05C branching fractions, in percent:

(1) $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$
(2) $\Gamma(\tau^- \to \mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma_{total}$
(3) $\Gamma(\tau^- \to \pi^- \nu_\tau)/\Gamma_{total}$
(4) $\Gamma(\tau^- \to \pi^- \pi^0 \nu_\tau)/\Gamma_{total}$
(5) $\Gamma(\tau^- \to \pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(6) $\Gamma(\tau^- \to \pi^- 3\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(7) $\Gamma(\tau^- \to h^- 4\pi^0 \nu_\tau (\text{ex.}K^0,\eta))/\Gamma_{total}$
(8) $\Gamma(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0,\omega))/\Gamma_{total}$
(9) $\Gamma(\tau^- \to \pi^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(10) $\Gamma(\tau^- \to h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(11) $\Gamma(\tau^- \to h^- h^- h^+ 3\pi^0 \nu_\tau)/\Gamma_{total}$
(12) $\Gamma(\tau^- \to 3h^- 2h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(13) $\Gamma(\tau^- \to 3h^- 2h^+ \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(2)	-20											
(3)	-9	-6										
(4)	-16	-12	2									
(5)	-5	-5	-17	-37								
(6)	0	-4	-15	2	-27							
(7)	-2	-4	-24	-15	20	-47						
(8)	-14	-9	15	-5	-17	-14	-8					
(9)	-13	-12	-25	-30	4	-2	16	-15				
(10)	0	-2	-23	-14	4	10	13	-6	-17			
(11)	1	0	-5	1	4	6	0	-9	-2	-11		
(12)	0	1	9	4	-8	-4	-6	9	-5	-4	-2	
(13)	1	-4	-3	-5	3	2	-4	-3	-1	4	1	-24

[49] The correlation coefficient between this measurement and the ACCIARRI 01F measurement of $B(\tau^- \to \mu^- \overline{\nu}_\mu \nu_\tau)$ is 0.08.

[50] The correlation coefficients between this measurement and the ANASTASSOV 97 measurements of $B(\mu\overline{\nu}_\mu\nu_\tau)$, $B(\mu\overline{\nu}_\mu\nu_\tau)/B(e\overline{\nu}_e\nu_\tau)$, $B(h^-\nu_\tau)$, and $B(h^-\nu_\tau)/B(e\overline{\nu}_e\nu_\tau)$ are 0.50, −0.42, 0.48, and −0.39 respectively.

[51] Not independent of ALBRECHT 92D $\Gamma(\mu^-\overline{\nu}_\mu\nu_\tau)/\Gamma(e^-\overline{\nu}_e\nu_\tau)$ and ALBRECHT 93G $\Gamma(\mu^-\overline{\nu}_\mu\nu_\tau) \times \Gamma(e^-\overline{\nu}_e\nu_\tau)/\Gamma^2_{total}$ values.

[52] Modified using $B(e^-\overline{\nu}_e\nu_\tau)$/B("1 prong") and B("1 prong") ,= 0.855.

[53] Error correlated with BALTRUSAITIS 85 $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma_{\text{total}}$.

[54] BACINO 78B value comes from fit to events with $e^\pm$ and one other nonelectron charged prong.

$\Gamma(e^- \overline{\nu}_e \nu_\tau \gamma)/\Gamma_{\text{total}}$ — Γ_6/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.75±0.06±0.17	[55] BERGFELD 00	CLEO	E^{ee}_{cm}= 10.6 GeV

[55] BERGFELD 00 impose requirements on detected γ's corresponding to a τ-rest-frame energy cutoff $E^*_\gamma > 10$ MeV.

$\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma(e^- \overline{\nu}_e \nu_\tau)$ — Γ_3/Γ_5

Standard Model prediction including mass effects is 0.9726.

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE		DOCUMENT ID	TECN	COMMENT
0.973 ±0.004 OUR FIT				
0.978 ±0.011 OUR AVERAGE				
0.9777±0.0063±0.0087	f&a	[56] ANASTASSOV 97	CLEO	E^{ee}_{cm}= 10.6 GeV
0.997 ±0.035 ±0.040	f&a	ALBRECHT 92D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[56] The correlation coefficients between this measurement and the ANASTASSOV 97 measurements of B($\mu \overline{\nu}_\mu \nu_\tau$), B($e \overline{\nu}_e \nu_\tau$), B($h^- \nu_\tau$), and B($h^- \nu_\tau$)/B($e \overline{\nu}_e \nu_\tau$) are 0.58, −0.42, 0.07, and 0.45 respectively.

$\Gamma(h^- \geq 0K^0_L\, \nu_\tau)/\Gamma_{\text{total}}$ — Γ_7/Γ

$\Gamma_7/\Gamma = (\Gamma_9+\Gamma_{10}+\frac{1}{2}\Gamma_{35}+\frac{1}{2}\Gamma_{37}+\Gamma_{47})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID	TECN	COMMENT
12.14±0.07 OUR FIT Error includes scale factor of 1.1.					
12.2 ±0.4 OUR AVERAGE					
12.47±0.26±0.43	f&a	2967	[57] ACCIARRI 95	L3	1992 LEP run
12.4 ±0.7 ±0.7	f&a	283	[58] ABREU 92N	DLPH	1990 LEP run
12.1 ±0.7 ±0.5	f&a	309	ALEXANDER 91D	OPAL	1990 LEP run
11.3 ±0.5 ±0.8	avg	798	[59] FORD 87	MAC	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12.44±0.11±0.11		15k	[60] BUSKULIC 96	ALEP	Repl. by SCHAEL 05C
11.7 ±0.6 ±0.8			[61] ALBRECHT 92D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
12.98±0.44±0.33			[62] DECAMP 92C	ALEP	Repl. by SCHAEL 05C
12.3 ±0.9 ±0.5		1338	BEHREND 90	CELL	E^{ee}_{cm}= 35 GeV
11.1 ±1.1 ±1.4			[63] BURCHAT 87	MRK2	E^{ee}_{cm}= 29 GeV
12.3 ±0.6 ±1.1		328	[64] BARTEL 86D	JADE	E^{ee}_{cm}= 34.6 GeV
13.0 ±2.0 ±4.0			BERGER 85	PLUT	E^{ee}_{cm}= 34.6 GeV
11.2 ±1.7 ±1.2		34	[65] BEHREND 83C	CELL	E^{ee}_{cm}= 34 GeV

[57] ACCIARRI 95 with 0.65% added to remove their correction for $\pi^- K^0_L$ backgrounds.

[58] ABREU 92N with 0.5% added to remove their correction for $K^*(892)^-$ backgrounds.

[59] FORD 87 result for B($\pi^- \nu_\tau$) with 0.67% added to remove their K^- correction and adjusted for 1992 B("1 prong").

[60] BUSKULIC 96 quote 11.78 ± 0.11 ± 0.13 We add 0.66 to undo their correction for unseen K^0_L and modify the systematic error accordingly.

[61] Not independent of ALBRECHT 92D $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)/\Gamma(e^- \overline{\nu}_e \nu_\tau)$, $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau) \times \Gamma(e^- \overline{\nu}_e \nu_\tau)$, and $\Gamma(h^- \geq 0 K^0_L \nu_\tau)/\Gamma(e^- \overline{\nu}_e \nu_\tau)$ values.

[62] DECAMP 92C quote B($h^- \geq 0 K^0_L \geq 0 (K^0_S \to \pi^+ \pi^-) \nu_\tau$) $= 13.32 \pm 0.44 \pm 0.33$. We subtract 0.35 to correct for their inclusion of the K^0_S decays.

[63] BURCHAT 87 with 1.1% added to remove their correction for K^- and $K^*(892)^-$ backgrounds.

[64] BARTEL 86D result for B($\pi^- \nu_\tau$) with 0.59% added to remove their K^- correction and adjusted for 1992 B("1 prong").

[65] BEHREND 83C quote B($\pi^- \nu_\tau$) $= 9.9 \pm 1.7 \pm 1.3$ after subtracting 1.3 ± 0.5 to correct for B($K^- \nu_\tau$).

$\Gamma(h^- \nu_\tau)/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma = (\Gamma_9+\Gamma_{10})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

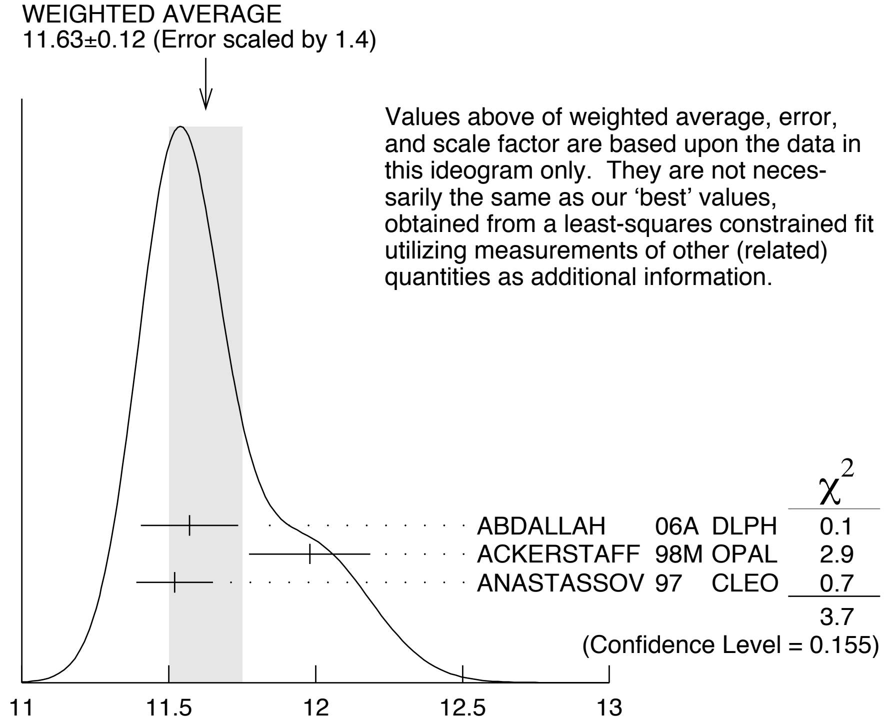
VALUE (%)		EVTS	DOCUMENT ID	TECN	COMMENT
11.59 ±0.06 OUR FIT Error includes scale factor of 1.1.					
11.63 ±0.12 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.					
11.571±0.120±0.114	f&a	19k	[66] ABDALLAH 06A	DLPH	1992–1995 LEP runs
11.98 ±0.13 ±0.16	f&a		ACKERSTAFF 98M	OPAL	1991–1995 LEP runs
11.52 ±0.05 ±0.12	f&a		[67] ANASTASSOV 97	CLEO	E^{ee}_{cm}= 10.6 GeV

[66] Correlation matrix for ABDALLAH 06A branching fractions, in percent:

(1) $\Gamma(\tau^- \rightarrow h^- \nu_\tau)/\Gamma_{total}$
(2) $\Gamma(\tau^- \rightarrow h^- \pi^0 \nu_\tau)/\Gamma_{total}$
(3) $\Gamma(\tau^- \rightarrow h^- \geq 1\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(4) $\Gamma(\tau^- \rightarrow h^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(5) $\Gamma(\tau^- \rightarrow h^- \geq 3\pi^0 \nu_\tau (\text{ex. } K^0))/\Gamma_{total}$
(6) $\Gamma(\tau^- \rightarrow h^- h^- h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(7) $\Gamma(\tau^- \rightarrow h^- h^- h^+ \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(8) $\Gamma(\tau^- \rightarrow h^- h^- h^+ \geq 1\pi^0 \nu_\tau (\text{ex. } K^0))/\Gamma_{total}$
(9) $\Gamma(\tau^- \rightarrow h^- h^- h^+ \geq 2\pi^0 \nu_\tau (\text{ex. } K^0))/\Gamma_{total}$
(10) $\Gamma(\tau^- \rightarrow 3h^- 2h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
(11) $\Gamma(\tau^- \rightarrow 3h^- 2h^+ \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(2)	-34									
(3)	-47	56								
(4)	6	-66	15							
(5)	-6	38	11	-86						
(6)	-7	-8	15	0	-2					
(7)	-2	-1	-5	-3	3	-53				
(8)	-4	-4	-13	-4	-2	-56	75			
(9)	-1	-1	-4	3	-6	26	-78	-16		
(10)	-1	-1	1	0	0	-2	-3	-1	3	
(11)	0	0	0	0	0	1	0	-5	5	-57

[67] The correlation coefficients between this measurement and the ANASTASSOV 97 measurements of B($\mu\overline{\nu}_\mu\nu_\tau$), B($e\overline{\nu}_e\nu_\tau$), B($\mu\overline{\nu}_\mu\nu_\tau$)/B($e\overline{\nu}_e\nu_\tau$), and B($h^-\nu_\tau$)/B($e\overline{\nu}_e\nu_\tau$) are 0.50, 0.48, 0.07, and 0.63 respectively.



$\Gamma\big(h^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma = (\Gamma_9+\Gamma_{10})/\Gamma$

$\Gamma\big(h^- \nu_\tau\big)/\Gamma\big(e^- \overline{\nu}_e \nu_\tau\big)$ $\Gamma_8/\Gamma_5 = (\Gamma_9+\Gamma_{10})/\Gamma_5$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE		*DOCUMENT ID*	*TECN*	*COMMENT*
0.650 ±0.004 OUR FIT	Error includes scale factor of 1.1.			
0.6484±0.0041±0.0060	**avg**	[68] ANASTASSOV 97	CLEO	E^{ee}_{cm}= 10.6 GeV

[68] The correlation coefficients between this measurement and the ANASTASSOV 97 measurements of B($\mu\overline{\nu}_\mu\nu_\tau$), B($e\overline{\nu}_e\nu_\tau$), B($\mu\overline{\nu}_\mu\nu_\tau$)/B($e\overline{\nu}_e\nu_\tau$), and B($h^-\nu_\tau$) are 0.08, −0.39, 0.45, and 0.63 respectively.

$\Gamma\big(\pi^- \nu_\tau\big)/\Gamma_{\text{total}}$ Γ_9/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
10.90 ±0.07 OUR FIT	Error includes scale factor of 1.1.					
10.828±0.070±0.078	**f&a**	38k	[69] SCHAEL	05C	ALEP	1991-1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
11.06 ±0.11 ±0.14			[70] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
11.7 ±0.4 ±1.8		1138	BLOCKER	82D	MRK2	E^{ee}_{cm}= 3.5–6.7 GeV

[69] See footnote to SCHAEL 05C $\Gamma(\tau^- \rightarrow e^-\overline{\nu}_e\nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.
[70] Not independent of BUSKULIC 96 B($h^-\nu_\tau$) and B($K^-\nu_\tau$) values.

$\Gamma(K^- \nu_\tau)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.691±0.023 OUR FIT					
0.685±0.023 OUR AVERAGE					
0.658±0.027±0.029		[71] ABBIENDI	01J	OPAL	1990–1995 LEP runs
0.696±0.025±0.014	2032	BARATE	99K	ALEP	1991–1995 LEP runs
0.85 ±0.18	27	ABREU	94K	DLPH	LEP 1992 Z data
0.66 ±0.07 ±0.09	99	BATTLE	94	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.72 ±0.04 ±0.04	728	BUSKULIC	96	ALEP	Repl. by BARATE 99K
0.59 ±0.18	16	MILLS	84	DLCO	E^{ee}_{cm}= 29 GeV
1.3 ±0.5	15	BLOCKER	82B	MRK2	E^{ee}_{cm}= 3.9–6.7 GeV

[71] The correlation coefficient between this measurement and the ABBIENDI 01J B($\tau^- \rightarrow K^- \geq 0\pi^0 \geq 0K^0 \geq 0\gamma\ \nu_\tau$) is 0.60.

$\Gamma(h^- \geq 1\,\text{neutrals}\,\nu_\tau)/\Gamma_{total}$ Γ_{11}/Γ

$\Gamma_{11}/\Gamma = (\Gamma_{14}+\Gamma_{16}+\Gamma_{20}+\Gamma_{23}+\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.157\Gamma_{35}+0.157\Gamma_{37}+0.157\Gamma_{40}+0.157\Gamma_{42}+0.0985\Gamma_{47}+0.708\Gamma_{124}+0.715\Gamma_{126}+0.09\Gamma_{144}+0.09\Gamma_{146})/\Gamma$

VALUE (%)	DOCUMENT ID		TECN	COMMENT
37.05±0.12 OUR FIT Error includes scale factor of 1.3.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
36.14±0.33±0.58	[72] AKERS	94E	OPAL	1991–1992 LEP runs
38.4 ±1.2 ±1.0	[73] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
42.7 ±2.0 ±2.9	BERGER	85	PLUT	E^{ee}_{cm}= 34.6 GeV

[72] Not independent of ACKERSTAFF 98M B($h^- \pi^0 \nu_\tau$) and B($h^- \geq 2\pi^0 \nu_\tau$) values.

[73] BURCHAT 87 quote for B($\pi^\pm \geq 1$ neutralν_τ) = 0.378 ± 0.012 ± 0.010. We add 0.006 to account for contribution from ($K^{*-} \nu_\tau$) which they fixed at BR = 0.013.

$\Gamma(h^- \geq 1\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$
$\Gamma_{12}/\Gamma = (\Gamma_{14}+\Gamma_{16}+\Gamma_{20}+\Gamma_{23}+\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.325\Gamma_{124}+0.325\Gamma_{126})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
36.51 ±0.12 OUR FIT Error includes scale factor of 1.3.					
36.641±0.155±0.127 avg	45k	[74] ABDALLAH	06A	DLPH	1992–1995 LEP runs

[74] See footnote to ABDALLAH 06A $\Gamma(\tau^- \rightarrow h^- \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

$\Gamma(h^- \pi^0 \nu_\tau)/\Gamma_{total}$ $\Gamma_{13}/\Gamma = (\Gamma_{14}+\Gamma_{16})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
25.95 ±0.10 OUR FIT Error includes scale factor of 1.1.					
25.74 ±0.17 OUR AVERAGE					
25.740±0.201±0.138	35k	[75] ABDALLAH	06A	DLPH	1992–1995 LEP runs
25.89 ±0.17 ±0.29		ACKERSTAFF	98M	OPAL	1991–1995 LEP runs
25.05 ±0.35 ±0.50	6613	ACCIARRI	95	L3	1992 LEP run
25.87 ±0.12 ±0.42	51k	[76] ARTUSO	94	CLEO	E^{ee}_{cm}= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

25.76	±0.15	±0.13	31k		BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
25.98	±0.36	±0.52		[77]	AKERS	94E	OPAL	Repl. by ACKERSTAFF 98M
22.9	±0.8	±1.3	283	[78]	ABREU	92N	DLPH	E^{ee}_{cm}= 88.2–94.2 GeV
23.1	±0.4	±0.9	1249	[79]	ALBRECHT	92Q	ARG	E^{ee}_{cm}= 10 GeV
25.02	±0.64	±0.88	1849		DECAMP	92C	ALEP	1989–1990 LEP runs
22.0	±0.8	±1.9	779		ANTREASYAN	91	CBAL	E^{ee}_{cm}= 9.4–10.6 GeV
22.6	±1.5	±0.7	1101		BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
23.1	±1.9	±1.6			BEHREND	84	CELL	E^{ee}_{cm}= 14,22 GeV

[75] See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[76] ARTUSO 94 reports the combined result from three independent methods, one of which (23% of the $\tau^- \to h^- \pi^0 \nu_\tau$) is normalized to the inclusive one-prong branching fraction, taken as 0.854 ± 0.004. Renormalization to the present value causes negligible change.

[77] AKERS 94E quote $(26.25 \pm 0.36 \pm 0.52) \times 10^{-2}$; we subtract 0.27% from their number to correct for $\tau^- \to h^- K^0_L \nu_\tau$.

[78] ABREU 92N with 0.5% added to remove their correction for $K^*(892)^-$ backgrounds.

[79] ALBRECHT 92Q with 0.5% added to remove their correction for $\tau^- \to K^*(892)^- \nu_\tau$ background.

$\Gamma(\pi^-\pi^0\nu_\tau)/\Gamma_{total}$ Γ_{14}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)				EVTS		DOCUMENT ID		TECN	COMMENT
25.50	**±0.10**	**OUR FIT**	Error includes scale factor of 1.1.						
25.46	**±0.12**	**OUR AVERAGE**							
25.471	±0.097	±0.085	f&a	81k	[80]	SCHAEL	05C	ALEP	1991-1995 LEP runs
25.36	±0.44		avg		[81]	ARTUSO	94	CLEO	E^{ee}_{cm}= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

25.30	±0.15	±0.13		[82]	BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
21.5	±0.4	±1.9	4400	[83,84]	ALBRECHT	88L	ARG	E^{ee}_{cm}= 10 GeV
23.0	±1.3	±1.7	582		ADLER	87B	MRK3	E^{ee}_{cm}= 3.77 GeV
25.8	±1.7	±2.5		[85]	BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
22.3	±0.6	±1.4	629	[84]	YELTON	86	MRK2	E^{ee}_{cm}= 29 GeV

[80] See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[81] Not independent of ARTUSO 94 B($h^- \pi^0 \nu_\tau$) and BATTLE 94 B($K^- \pi^0 \nu_\tau$) values.

[82] Not independent of BUSKULIC 96 B($h^- \pi^0 \nu_\tau$) and B($K^- \pi^0 \nu_\tau$) values.

[83] The authors divide by $(\Gamma_3 + \Gamma_5 + \Gamma_9 + \Gamma_{10})/\Gamma = 0.467$ to obtain this result.

[84] Experiment had no hadron identification. Kaon corrections were made, but insufficient information is given to permit their removal.

[85] BURCHAT 87 value is not independent of YELTON 86 value. Nonresonant decays included.

$\Gamma(\pi^- \pi^0 \text{non-}\rho(770) \nu_\tau)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.3±0.1 ±0.3	[86] BEHREND	84	CELL	E^{ee}_{cm}= 14,22 GeV

[86] BEHREND 84 assume a flat nonresonant mass distribution down to the $\rho(770)$ mass, using events with mass above 1300 to set the level.

$\Gamma(K^- \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.452±0.027 OUR FIT					
0.454±0.030 OUR AVERAGE					
0.471±0.059±0.023	360	ABBIENDI	04J	OPAL	1991-1995 LEP runs
0.444±0.026±0.024	923	BARATE	99K	ALEP	1991-1995 LEP runs
0.51 ±0.10 ±0.07	37	BATTLE	94	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.52 ±0.04 ±0.05	395	BUSKULIC	96	ALEP	Repl. by BARATE 99K

$\Gamma(h^- \geq 2\pi^0 \nu_\tau)/\Gamma_{\text{total}}$ Γ_{17}/Γ

$\Gamma_{17}/\Gamma = (\Gamma_{20}+\Gamma_{23}+\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.157\Gamma_{35}+0.157\Gamma_{37}+0.157\Gamma_{40}+0.157\Gamma_{42}+0.0985\Gamma_{47}+0.319\Gamma_{124}+0.322\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
10.81±0.14 OUR FIT	Error includes scale factor of 1.5.					
9.91±0.31±0.27	**f&a**		ACKERSTAFF	98M	OPAL	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
9.89±0.34±0.55			[87] AKERS	94E	OPAL	Repl. by ACKERSTAFF 98M
14.0 ±1.2 ±0.6		938	[88] BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
12.0 ±1.4 ±2.5			[89] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
13.9 ±2.0 $^{+1.9}_{-2.2}$			[90] AIHARA	86E	TPC	E^{ee}_{cm}= 29 GeV

[87] AKERS 94E not independent of AKERS 94E B($h^- \geq 1\pi^0 \nu_\tau$) and B($h^- \pi^0 \nu_\tau$) measurements.

[88] No independent of BEHREND 90 $\Gamma(h^- 2\pi^0 \nu_\tau (\text{exp. } K^0))$ and $\Gamma(h^- \geq 3\pi^0 \nu_\tau)$.

[89] Error correlated with BURCHAT 87 $\Gamma(\rho^- \nu_e)/\Gamma(\text{total})$ value.

[90] AIHARA 86E (TPC) quote B($2\pi^0 \pi^- \nu_\tau$) + 1.6B($3\pi^0 \pi^- \nu_\tau$) + 1.1B($\pi^0 \eta \pi^- \nu_\tau$).

$\Gamma(h^- 2\pi^0 \nu_\tau)/\Gamma_{\text{total}}$ Γ_{18}/Γ

$\Gamma_{18}/\Gamma = (\Gamma_{20}+\Gamma_{23}+0.157\Gamma_{35}+0.157\Gamma_{37})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
9.47±0.12 OUR FIT	Error includes scale factor of 1.3.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9.48±0.13±0.10	12k	[91] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C

[91] BUSKULIC 96 quote 9.29 ± 0.13 ± 0.10. We add 0.19 to undo their correction for $\tau^- \rightarrow h^- K^0 \nu_\tau$.

$\Gamma(h^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ — Γ_{19}/Γ

$\Gamma_{19}/\Gamma = (\Gamma_{20}+\Gamma_{23})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. f&a marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
9.31 ±0.12 OUR FIT			Error includes scale factor of 1.3.			
9.17 ±0.27 OUR AVERAGE						
9.498±0.320±0.275	f&a	9.5k	[92] ABDALLAH	06A	DLPH	1992–1995 LEP runs
8.88 ±0.37 ±0.42	f&a	1060	ACCIARRI	95	L3	1992 LEP run
8.96 ±0.16 ±0.44	avg		[93] PROCARIO	93	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
10.38 ±0.66 ±0.82		809	[94] DECAMP	92C	ALEP	Repl. by SCHAEL 05C
5.7 ±0.5 $^{+1.7}_{-1.0}$		133	[95] ANTREASYAN	91	CBAL	E^{ee}_{cm}= 9.4–10.6 GeV
10.0 ±1.5 ±1.1		333	[96] BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
8.7 ±0.4 ±1.1		815	[97] BAND	87	MAC	E^{ee}_{cm}= 29 GeV
6.2 ±0.6 ±1.2			[98] GAN	87	MRK2	E^{ee}_{cm}= 29 GeV
6.0 ±3.0 ±1.8			BEHREND	84	CELL	E^{ee}_{cm}= 14,22 GeV

[92] See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

[93] PROCARIO 93 entry is obtained from $B(h^- 2\pi^0 \nu_\tau)/B(h^- \pi^0 \nu_\tau)$ using ARTUSO 94 result for $B(h^- \pi^0 \nu_\tau)$.

[94] We subtract 0.0015 to account for $\tau^- \to K^*(892)^- \nu_\tau$ contribution.

[95] ANTREASYAN 91 subtract 0.001 to account for the $\tau^- \to K^*(892)^- \nu_\tau$ contribution.

[96] BEHREND 90 subtract 0.002 to account for the $\tau^- \to K^*(892)^- \nu_\tau$ contribution.

[97] BAND 87 assume $B(\pi^- 3\pi^0 \nu_\tau) = 0.01$ and $B(\pi^- \pi^0 \eta \nu_\tau) = 0.005$.

[98] GAN 87 analysis use photon multiplicity distribution.

$\Gamma(h^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma(h^- \pi^0 \nu_\tau)$ — Γ_{19}/Γ_{13}

$\Gamma_{19}/\Gamma_{13} = (\Gamma_{20}+\Gamma_{23})/(\Gamma_{14}+\Gamma_{16})$

VALUE	DOCUMENT ID		TECN	COMMENT
0.359±0.006 OUR FIT	Error includes scale factor of 1.3.			
0.342±0.006±0.016	[99] PROCARIO	93	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV

[99] PROCARIO 93 quote 0.345 ± 0.006 ± 0.016 after correction for 2 kaon backgrounds assuming $B(K^{*-} \nu_\tau)$=1.42 ± 0.18% and $B(h^- K^0 \pi^0 \nu_\tau)$=0.48 ± 0.48%. We multiply by 0.990 ± 0.010 to remove these corrections to $B(h^- \pi^0 \nu_\tau)$.

$\Gamma(\pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ — Γ_{20}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
9.25 ±0.12 OUR FIT			Error includes scale factor of 1.3.			
9.239±0.086±0.090	**f&a**	31k	[100] SCHAEL	05C	ALEP	1991-1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
9.21 ±0.13 ±0.11			[101] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C

[100] See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[101] Not independent of BUSKULIC 96 B($h^- 2\pi^0 \nu_\tau$(ex. K^0)) and B($K^- 2\pi^0 \nu_\tau$(ex. K^0)) values.

$\Gamma(\pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0), \text{scalar})/\Gamma(\pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0))$ — Γ_{21}/Γ_{20}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.094	95	[102] BROWDER	00	CLEO	4.7 fb^{-1} E^{ee}_{cm}= 10.6 GeV

[102] Model-independent limit from structure function analysis on contribution to B($\tau^- \to \pi^- 2\pi^0 \nu_\tau$(ex. K^0)) from scalars.

$\Gamma(\pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0), \text{vector})/\Gamma(\pi^- 2\pi^0 \nu_\tau (\text{ex.}K^0))$ — Γ_{22}/Γ_{20}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.073	95	[103] BROWDER	00	CLEO	4.7 fb^{-1} E^{ee}_{cm}= 10.6 GeV

[103] Model-independent limit from structure function analysis on contribution to B($\tau^- \to \pi^- 2\pi^0 \nu_\tau$(ex. K^0)) from vectors.

$\Gamma(K^- 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$ — Γ_{23}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
5.8± 2.3 OUR FIT					
5.8± 2.4 OUR AVERAGE					
5.6± 2.0±1.5	131	BARATE	99K	ALEP	1991–1995 LEP runs
9 ±10 ±3	3	[104] BATTLE	94	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8 ± 2 ±2	59	BUSKULIC	96	ALEP	Repl. by BARATE 99K

[104] BATTLE 94 quote $(14 \pm 10 \pm 3) \times 10^{-4}$ or $< 30 \times 10^{-4}$ at 90% CL. We subtract $(5 \pm 2) \times 10^{-4}$ to account for $\tau^- \to K^-(K^0 \to \pi^0\pi^0)\nu_\tau$ background.

$\Gamma(h^- \geq 3\pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{24}/Γ

$\Gamma_{24}/\Gamma = (\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.157\Gamma_{40}+0.157\Gamma_{42}+0.0985\Gamma_{47}+0.319\Gamma_{124}+0.322\Gamma_{126})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.33±0.07 OUR FIT Error includes scale factor of 1.1.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.53±0.40±0.46	186	DECAMP	92C	ALEP	Repl. by SCHAEL 05C
3.2 ±1.0 ±1.0		BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV

$\Gamma(h^- \geq 3\pi^0 \nu_\tau (\text{ex. } K^0))/\Gamma_{total}$

$\Gamma_{25}/\Gamma = (\Gamma_{27}+\Gamma_{28}+\Gamma_{30}+0.325\Gamma_{124}+0.325\Gamma_{126})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.25 ±0.07 OUR FIT Error includes scale factor of 1.1.					
1.403±0.214±0.224	1.1k	[105] ABDALLAH	06A	DLPH	1992–1995 LEP runs

[105] See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

$\Gamma(h^- 3\pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{26}/Γ

$\Gamma_{26}/\Gamma = (\Gamma_{27}+\Gamma_{28}+0.157\Gamma_{40}+0.157\Gamma_{42}+0.322\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.17±0.08 OUR FIT	Error includes scale factor of 1.1.					
1.21±0.17 OUR AVERAGE	Error includes scale factor of 1.2.					
1.70±0.24±0.38	f&a	293	ACCIARRI	95	L3	1992 LEP run
1.15±0.08±0.13	avg		[106] PROCARIO	93	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.24±0.09±0.11		2.3k	[107] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
$0.0\ {}^{+1.4}_{-0.1}\ {}^{+1.1}_{-0.1}$			[108] GAN	87	MRK2	E^{ee}_{cm}= 29 GeV

[106] PROCARIO 93 entry is obtained from $B(h^- 3\pi^0 \nu_\tau)/B(h^- \pi^0 \nu_\tau)$ using ARTUSO 94 result for $B(h^- \pi^0 \nu_\tau)$.

[107] BUSKULIC 96 quote $B(h^- 3\pi^0 \nu_\tau (\text{ex. } K^0))$ = 1.17 ± 0.09 ± 0.11. We add 0.07 to remove their correction for K^0 backgrounds.

[108] Highly correlated with GAN 87 $\Gamma(\eta\pi^- \pi^0 \nu_\tau)/\Gamma_{total}$ value. Authors quote $B(\pi^\pm 3\pi^0 \nu_\tau) + 0.67B(\pi^\pm \eta\pi^0 \nu_\tau) = 0.047 \pm 0.010 \pm 0.011$.

$\Gamma(h^- 3\pi^0 \nu_\tau)/\Gamma(h^- \pi^0 \nu_\tau)$ Γ_{26}/Γ_{13}

$\Gamma_{26}/\Gamma_{13} = (\Gamma_{27}+\Gamma_{28}+0.157\Gamma_{40}+0.157\Gamma_{42}+0.322\Gamma_{126})/(\Gamma_{14}+\Gamma_{16})$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.0452±0.0030 OUR FIT	Error includes scale factor of 1.1.			
0.044 ±0.003 ±0.005	[109] PROCARIO	93	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV

[109] PROCARIO 93 quote 0.041 ± 0.003 ± 0.005 after correction for 2 kaon backgrounds assuming $B(K^{*-} \nu_\tau)$=1.42 ± 0.18% and $B(h^- K^0 \pi^0 \nu_\tau)$=0.48 ± 0.48%. We add 0.003 ± 0.003 and multiply the sum by 0.990 ± 0.010 to remove these corrections.

$\Gamma(\pi^- 3\pi^0 \nu_\tau (\text{ex.} K^0))/\Gamma_{total}$ Γ_{27}/Γ

VALUE (%)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.04 ±0.08 OUR FIT	Error includes scale factor of 1.1.				
0.977±0.069±0.058	6.1k	[110] SCHAEL	05C	ALEP	1991-1995 LEP runs

[110] See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

$\Gamma(K^- 3\pi^0 \nu_\tau (\text{ex.} K^0, \eta))/\Gamma_{total}$ Γ_{28}/Γ

VALUE (units 10^{-4})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.2± 2.1 OUR FIT					
3.7± 2.1±1.1	22	BARATE	99K	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5 ±13		[111] BUSKULIC	94E	ALEP	Repl. by BARATE 99K

[111] BUSKULIC 94E quote $B(K^- \geq 0\pi^0 \geq 0K^0 \nu_\tau) - [B(K^- \nu_\tau) + B(K^- \pi^0 \nu_\tau) + B(K^- K^0 \nu_\tau) + B(K^- \pi^0 \pi^0 \nu_\tau) + B(K^- \pi^0 K^0 \nu_\tau)] = (5 \pm 13) \times 10^{-4}$ accounting for common systematic errors in BUSKULIC 94E and BUSKULIC 94F measurements of these modes. We assume $B(K^- \geq 2K^0 \nu_\tau)$ and $B(K^- \geq 4\pi^0 \nu_\tau)$ are negligible.

$\Gamma(h^- 4\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ Γ_{29}/Γ

$\Gamma_{29}/\Gamma = (\Gamma_{30}+0.319\Gamma_{124})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.16±0.04 OUR FIT					
0.16±0.05±0.05		[112] PROCARIO	93	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.16±0.04±0.09	232	[113] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C

[112] PROCARIO 93 quotes B($h^- 4\pi^0 \nu_\tau$)/B($h^- \pi^0 \nu_\tau$) =0.006 ± 0.002 ± 0.002. We multiply by the ARTUSO 94 result for B($h^- \pi^0 \nu_\tau$) to obtain B($h^- 4\pi^0 \nu_\tau$). PROCARIO 93 assume B($h^- \geq 5\ \pi^0 \nu_\tau$) is small and do not correct for it.

[113] BUSKULIC 96 quote result for $\tau^- \rightarrow h^- \geq 4\pi^0 \nu_\tau$. We assume B($h^- \geq 5\pi^0 \nu_\tau$) is negligible.

$\Gamma(h^- 4\pi^0 \nu_\tau (\text{ex.}K^0,\eta))/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.10 ±0.04 OUR FIT					
0.112±0.037±0.035	957	[114] SCHAEL	05C	ALEP	1991-1995 LEP runs

[114] See footnote to SCHAEL 05C $\Gamma(\tau^- \rightarrow e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

$\Gamma(K^- \geq 0\pi^0 \geq 0K^0 \geq 0\gamma\ \nu_\tau)/\Gamma_{\text{total}}$ Γ_{31}/Γ

$\Gamma_{31}/\Gamma = (\Gamma_{10}+\Gamma_{16}+\Gamma_{23}+\Gamma_{28}+\Gamma_{37}+\Gamma_{42}+0.715\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
1.57 ±0.04 OUR FIT Error includes scale factor of 1.1.						
1.53 ±0.04 OUR AVERAGE						
1.528±0.039±0.040	f&a		[115] ABBIENDI	01J	OPAL	1990–1995 LEP runs
1.520±0.040±0.041	avg	4006	[116] BARATE	99K	ALEP	1991–1995 LEP runs
1.54 ±0.24	f&a		ABREU	94K	DLPH	LEP 1992 Z data
1.70 ±0.12 ±0.19	f&a	202	[117] BATTLE	94	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.70 ±0.05 ±0.06		1610	[118] BUSKULIC	96	ALEP	Repl. by BARATE 99K
1.6 ±0.4 ±0.2		35	AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV
1.71 ±0.29		53	MILLS	84	DLCO	E^{ee}_{cm}= 29 GeV

[115] The correlation coefficient between this measurement and the ABBIENDI 01J B($\tau^- \rightarrow K^- \nu_\tau$) is 0.60.

[116] Not independent of BARATE 99K B($K^- \nu_\tau$), B($K^- \pi^0 \nu_\tau$), B($K^- 2\pi^0 \nu_\tau$(ex. K^0)), B($K^- 3\pi^0 \nu_\tau$(ex. K^0)), B($K^- K^0 \nu_\tau$), and B($K^- K^0 \pi^0 \nu_\tau$) values.

[117] BATTLE 94 quote 1.60 ± 0.12 ± 0.19. We add 0.10 ± 0.02 to correct for their rejection of $K^0_S \rightarrow \pi^+ \pi^-$ decays.

[118] Not independent of BUSKULIC 96 B($K^- \nu_\tau$), B($K^- \pi^0 \nu_\tau$), B($K^- 2\pi^0 \nu_\tau$), B($K^- K^0 \nu_\tau$), and B($K^- K^0 \pi^0 \nu_\tau$) values.

$\Gamma(K^- \geq 1 (\pi^0 \text{ or } K^0 \text{ or } \gamma)\ \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{32}/Γ

$\Gamma_{32}/\Gamma = (\Gamma_{16}+\Gamma_{23}+\Gamma_{28}+\Gamma_{37}+\Gamma_{42}+0.715\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.878±0.033 OUR FIT						
0.86 ±0.05 OUR AVERAGE						
0.869±0.031±0.034	avg		[119] ABBIENDI	01J	OPAL	1990–1995 LEP runs
0.69 ±0.25	avg		[120] ABREU	94K	DLPH	LEP 1992 Z data
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.2 ±0.5 $^{+0.2}_{-0.4}$		9	AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV

[119] Not independent of ABBIENDI 01J B($\tau^- \rightarrow K^- \nu_\tau$) and B($\tau^- \rightarrow K^- \geq 0\pi^0 \geq 0K^0 \geq 0\gamma\ \nu_\tau$) values.

[120] Not independent of ABREU 94K B($K^- \nu_\tau$) and B($K^- \geq 0$ neutralsν_τ) measurements.

$\Gamma(K^0_S\,(\text{particles})^-\,\nu_\tau)/\Gamma_{\text{total}}$ — Γ_{33}/Γ

$\Gamma_{33}/\Gamma = (\frac{1}{2}\Gamma_{35}+\frac{1}{2}\Gamma_{37}+\frac{1}{2}\Gamma_{40}+\frac{1}{2}\Gamma_{42}+\Gamma_{47}+\Gamma_{48})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.927±0.034 OUR FIT Error includes scale factor of 1.1.					
0.97 ±0.07 OUR AVERAGE					
0.970±0.058±0.062	929	BARATE	98E	ALEP	1991–1995 LEP runs
0.97 ±0.09 ±0.06	141	AKERS	94G	OPAL	E^{ee}_{cm}= 88–94 GeV

$\Gamma(h^- \overline{K}^0 \nu_\tau)/\Gamma_{\text{total}}$ — $\Gamma_{34}/\Gamma = (\Gamma_{35}+\Gamma_{37})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
1.05 ±0.04 OUR FIT Error includes scale factor of 1.1.						
0.90 ±0.07 OUR AVERAGE						
1.01 ±0.11 ±0.07	avg	555	[121] BARATE	98E	ALEP	1991–1995 LEP runs
0.855±0.036±0.073	f&a	1242	COAN	96	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV

[121] Not independent of BARATE 98E B($\tau^- \rightarrow \pi^- \overline{K}^0 \nu_\tau$) and B($\tau^- \rightarrow K^- K^0 \nu_\tau$) values.

$\Gamma(\pi^- \overline{K}^0 \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{35}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.90 ±0.04 OUR FIT Error includes scale factor of 1.1.						
0.88 ±0.05 OUR AVERAGE Error includes scale factor of 1.2.						
0.933±0.068±0.049	f&a	377	ABBIENDI	00C	OPAL	1991–1995 LEP runs
0.928±0.045±0.034	f&a	937	[122] BARATE	99K	ALEP	1991–1995 LEP runs
0.855±0.117±0.066	avg	509	[123] BARATE	98E	ALEP	1991–1995 LEP runs

0.704±0.041±0.072	avg		[124] COAN	96	CLEO	$E^{ee}_{\rm cm} \approx$ 10.6 GeV
0.95 ±0.15 ±0.06	f&a		[125] ACCIARRI	95F	L3	1991–1993 LEP runs

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.79 ±0.10 ±0.09		98	[126] BUSKULIC	96	ALEP	Repl. by BARATE 99K

[122] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter.

[123] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+\pi^-$ decays. Not independent of BARATE 98E B(K^0 particles$^-\nu_\tau$) value.

[124] Not independent of COAN 96 B($h^- K^0 \nu_\tau$) and B($K^- K^0 \nu_\tau$) measurements.

[125] ACCIARRI 95F do not identify π^-/K^- and assume B($K^- K^0 \nu_\tau$) = (0.29 ± 0.12)%.

[126] BUSKULIC 96 measure K^0's by detecting K^0_L's in their hadron calorimeter.

$\Gamma(\pi^- \overline{K}^0 (\text{non-}K^*(892)^-) \nu_\tau)/\Gamma_{\rm total}$ Γ_{36}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.17	95	ACCIARRI	95F	L3	1991–1993 LEP runs

$\Gamma(K^- K^0 \nu_\tau)/\Gamma_{\rm total}$ Γ_{37}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.153±0.016 OUR FIT					
0.158±0.017 OUR AVERAGE					
0.162±0.021±0.011	150	[127] BARATE	99K	ALEP	1991–1995 LEP runs
0.158±0.042±0.017	46	[128] BARATE	98E	ALEP	1991–1995 LEP runs
0.151±0.021±0.022	111	COAN	96	CLEO	$E^{ee}_{\rm cm} \approx$ 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.26 ±0.09 ±0.02	13	[129] BUSKULIC	96	ALEP	Repl. by BARATE 99K

[127] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter.

[128] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+\pi^-$ decays.

[129] BUSKULIC 96 measure K^0's by detecting K^0_L's in their hadron calorimeter.

$\Gamma(K^- K^0 \geq 0\pi^0 \nu_\tau)/\Gamma_{\rm total}$ $\Gamma_{38}/\Gamma = (\Gamma_{37}+\Gamma_{42})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.307±0.024 OUR FIT					
0.330±0.055±0.039	124	ABBIENDI	00C	OPAL	1991–1995 LEP runs

$\Gamma(h^- \overline{K}^0 \pi^0 \nu_\tau)/\Gamma_{\rm total}$ $\Gamma_{39}/\Gamma = (\Gamma_{40}+\Gamma_{42})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.53 ±0.04 OUR FIT						
0.50 ±0.06 OUR AVERAGE Error includes scale factor of 1.2.						
0.446±0.052±0.046	avg	157	[130] BARATE	98E	ALEP	1991–1995 LEP runs
0.562±0.050±0.048	f&a	264	COAN	96	CLEO	$E^{ee}_{\rm cm} \approx$ 10.6 GeV

[130] Not independent of BARATE 98E B($\tau^- \rightarrow \pi^- \overline{K}^0 \pi^0 \tau$) and B($\tau^- \rightarrow K^- K^0 \pi^0 \nu_\tau$) values.

$\Gamma(\pi^- \overline{K}^0 \pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{40}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.38 ±0.04 OUR FIT						
0.36 ±0.04 OUR AVERAGE						
0.347±0.053±0.037	f&a	299	[131] BARATE	99K	ALEP	1991–1995 LEP runs
0.294±0.073±0.037	f&a	142	[132] BARATE	98E	ALEP	1991–1995 LEP runs
0.417±0.058±0.044	avg		[133] COAN	96	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
0.41 ±0.12 ±0.03	f&a		[134] ACCIARRI	95F	L3	1991–1993 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.32 ±0.11 ±0.05		23	[135] BUSKULIC	96	ALEP	Repl. by BARATE 99K

[131] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter.

[132] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+\pi^-$ decays.

[133] Not independent of COAN 96 B($h^- K^0 \pi^0 \nu_\tau$) and B($K^- K^0 \pi^0 \nu_\tau$) measurements.

[134] ACCIARRI 95F do not identify π^-/K^- and assume B($K^- K^0 \pi^0 \nu_\tau$) = (0.05 ± 0.05)%.

[135] BUSKULIC 96 measure K^0's by detecting K^0_L's in their hadron calorimeter.

$\Gamma(\overline{K}^0 \rho^- \nu_\tau)/\Gamma_{total}$ Γ_{41}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.22 ±0.05 OUR AVERAGE				
0.250±0.057±0.044	[136] BARATE	99K	ALEP	1991–1995 LEP runs
0.188±0.054±0.038	[137] BARATE	98E	ALEP	1991–1995 LEP runs

[136] BARATE 99K measure K^0's by detecting K^0_L's in hadron calorimeter. They determine the $\overline{K}^0 \rho^-$ fraction in $\tau^- \rightarrow \pi^- \overline{K}^0 \pi^0 \nu_\tau$ decays to be $(0.72 \pm 0.12 \pm 0.10)$ and multiply their B($\pi^- \overline{K}^0 \pi^0 \nu_\tau$) measurement by this fraction to obtain the quoted result.

[137] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+\pi^-$ decays. They determine the $\overline{K}^0 \rho^-$ fraction in $\tau^- \rightarrow \pi^- \overline{K}^0 \pi^0 \nu_\tau$ decays to be $(0.64 \pm 0.09 \pm 0.10)$ and multiply their B($\pi^- \overline{K}^0 \pi^0 \nu_\tau$) measurement by this fraction to obtain the quoted result.

$\Gamma(K^- K^0 \pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{42}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.154±0.020 OUR FIT					
0.144±0.023 OUR AVERAGE					
0.143±0.025±0.015	78	[138] BARATE	99K	ALEP	1991–1995 LEP runs
0.152±0.076±0.021	15	[139] BARATE	98E	ALEP	1991–1995 LEP runs
0.145±0.036±0.020	32	COAN	96	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.10 ±0.05 ±0.03	5	[140] BUSKULIC	96	ALEP	Repl. by BARATE 99K

[138] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter.

[139] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+\pi^-$ decays.

[140] BUSKULIC 96 measure K^0's by detecting K^0_L's in their hadron calorimeter.

$\Gamma(\pi^- \overline{K}^0 \geq 1\pi^0 \nu_\tau)/\Gamma_{total}$ — $\Gamma_{43}/\Gamma = (\Gamma_{40}+\Gamma_{44})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.324±0.074±0.066	148	ABBIENDI	00C	OPAL	1991–1995 LEP runs

$\Gamma(\pi^- \overline{K}^0 \pi^0 \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.26±0.24			[141] BARATE	99R	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.66	95	17	[142] BARATE	99K	ALEP	1991–1995 LEP runs
0.58±0.33±0.14		5	[143] BARATE	98E	ALEP	1991–1995 LEP runs

[141] BARATE 99R combine the BARATE 98E and BARATE 99K measurements to obtain this value.

[142] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter.

[143] BARATE 98E reconstruct K^0's using $K^0_S \to \pi^+\pi^-$ decays.

$\Gamma(K^- K^0 \pi^0 \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{45}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.16 × 10^{-3}	95	[144] BARATE	99R	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<0.18 \times 10^{-3}$	95	[145] BARATE	99K	ALEP	1991–1995 LEP runs
$<0.39 \times 10^{-3}$	95	[146] BARATE	98E	ALEP	1991–1995 LEP runs

[144] BARATE 99R combine the BARATE 98E and BARATE 99K bounds to obtain this value.

[145] BARATE 99K measure K^0's by detecting K^0_L's in hadron calorimeter.

[146] BARATE 98E reconstruct K^0's by using $K^0_S \to \pi^+\pi^-$ decays.

$\Gamma(\pi^- K^0 \overline{K}^0 \nu_\tau)/\Gamma_{total}$ — $\Gamma_{46}/\Gamma = (2\Gamma_{47}+\Gamma_{48})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.160±0.031 OUR FIT	Error includes scale factor of 1.2.					
0.153±0.030±0.016	**avg**	74	[147] BARATE	98E	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.31 ±0.12 ±0.04			[148] ACCIARRI	95F	L3	1991–1993 LEP runs

[147] BARATE 98E obtain this value by adding twice their B($\pi^- K^0_S K^0_S \nu_\tau$) value to their B($\pi^- K^0_S K^0_L \nu_\tau$) value.

[148] ACCIARRI 95F assume B($\pi^- K^0_S K^0_S \nu$)= B($\pi^- K^0_S K^0_L \nu$) = 1/2B($\pi^- K^0_S K^0_L \nu$).

$\Gamma(\pi^- K^0_S K^0_S \nu_\tau)/\Gamma_{total}$ — Γ_{47}/Γ

Bose-Einstein correlations might make the mixing fraction different than 1/4.

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.4±0.5 OUR FIT					
2.4±0.5 OUR AVERAGE					
2.6±1.0±0.5	6	BARATE	98E	ALEP	1991–1995 LEP runs
2.3±0.5±0.3	42	COAN	96	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV

$\Gamma(\pi^- K^0_S K^0_L \nu_\tau)/\Gamma_{total}$ — Γ_{48}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
11.2±3.0 OUR FIT	Error includes scale factor of 1.2.				
10.1±2.3±1.3	68	BARATE	98E	ALEP	1991–1995 LEP runs

$\Gamma(\pi^- K^0 \overline{K}^0 \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{49}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
(0.31±0.23) × 10^{-3}	[149] BARATE	99R	ALEP	1991–1995 LEP runs

[149] BARATE 99R combine BARATE 98E $\Gamma(\pi^- K^0_S K^0_S \pi^0 \nu_\tau)/\Gamma_{total}$ and $\Gamma(\pi^- K^0_S K^0_L \pi^0 \nu_\tau)/\Gamma_{total}$ measurements to obtain this value.

$\Gamma(\pi^- K^0_S K^0_S \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.0	95	BARATE	98E	ALEP	1991–1995 LEP runs

$\Gamma(\pi^- K^0_S K^0_L \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
3.1±1.1±0.5	11	BARATE	98E	ALEP	1991–1995 LEP runs

$\Gamma(K^0 h^+ h^- h^- \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{total}$ — Γ_{52}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.17	95	TSCHIRHART	88	HRS	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.27	90	BELTRAMI	85	HRS	E^{ee}_{cm}= 29 GeV

$\Gamma(K^0 h^+ h^- h^- \nu_\tau)/\Gamma_{total}$ — Γ_{53}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.3±1.9±0.7	6	[150] BARATE	98E	ALEP	1991–1995 LEP runs

[150] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+ \pi^-$ decays.

$\Gamma(h^- h^- h^+ \geq 0 \text{ neutrals } \geq 0 K^0_L \nu_\tau)/\Gamma_{total}$ — Γ_{54}/Γ

$\Gamma_{54}/\Gamma = (0.3431\Gamma_{35}+0.3431\Gamma_{37}+0.3431\Gamma_{40}+0.3431\Gamma_{42}+0.4307\Gamma_{47}+0.6861\Gamma_{48}+\Gamma_{62}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.9101\Gamma_{144}+0.9101\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
15.22± 0.09 OUR FIT	Error includes scale factor of 1.4.				
14.8 ± 0.4 OUR AVERAGE					
14.4 ± 0.6 ±0.3		ADEVA	91F	L3	E^{ee}_{cm}= 88.3–94.3 GeV
15.0 ± 0.4 ±0.3		BEHREND	89B	CELL	E^{ee}_{cm}= 14–47 GeV
15.1 ± 0.8 ±0.6		AIHARA	87B	TPC	E^{ee}_{cm}= 29 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

13.5 ± 0.3 ±0.3		ABACHI	89B	HRS	E^{ee}_{cm}= 29 GeV
12.8 ± 1.0 ±0.7		[151] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
12.1 ± 0.5 ±1.2		RUCKSTUHL	86	DLCO	E^{ee}_{cm}= 29 GeV
12.8 ± 0.5 ±0.8	1420	SCHMIDKE	86	MRK2	E^{ee}_{cm}= 29 GeV
15.3 ± 1.1 $^{+1.3}_{-1.6}$	367	ALTHOFF	85	TASS	E^{ee}_{cm}= 34.5 GeV
13.6 ± 0.5 ±0.8		BARTEL	85F	JADE	E^{ee}_{cm}= 34.6 GeV
12.2 ± 1.3 ±3.9		[152] BERGER	85	PLUT	E^{ee}_{cm}= 34.6 GeV
13.3 ± 0.3 ±0.6		FERNANDEZ	85	MAC	E^{ee}_{cm}= 29 GeV
24 ± 6	35	BRANDELIK	80	TASS	E^{ee}_{cm}= 30 GeV
32 ± 5	692	[153] BACINO	78B	DLCO	E^{ee}_{cm}= 3.1–7.4 GeV
35 ±11		[153] BRANDELIK	78	DASP	Assumes $V-A$ decay
18 ± 6.5	33	[153] JAROS	78	MRK1	$E^{ee}_{cm} > 6$ GeV

[151] BURCHAT 87 value is not independent of SCHMIDKE 86 value.

[152] Not independent of BERGER 85 $\Gamma(\mu^-\overline{\nu}_\mu\nu_\tau)/\Gamma_{total}$, $\Gamma(e^-\overline{\nu}_e\nu_\tau)/\Gamma_{total}$, $\Gamma(h^- \geq 1$ neutrals$\nu_\tau)/\Gamma_{total}$, and $\Gamma(h^- \geq 0K^0_L\ \nu_\tau)/\Gamma_{total}$, and therefore not used in the fit.

[153] Low energy experiments are not in average or fit because the systematic errors in background subtraction are judged to be large.

$\Gamma(h^-h^-h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^+\pi^-$)("3-prong"))$/\Gamma_{total}$ Γ_{55}/Γ

$\Gamma_{55}/\Gamma = (\Gamma_{62}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.9101\Gamma_{144}+0.9101\Gamma_{146})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
14.59 ±0.08 OUR FIT Error includes scale factor of 1.4.						
14.61 ±0.06 OUR AVERAGE						
14.652±0.067±0.086	avg		SCHAEL	05C	ALEP	1991-1995 LEP runs
14.569±0.093±0.048	avg	23k	[154] ABREU	01M	DLPH	1992–1995 LEP runs
14.556±0.105±0.076	f&a		[155] ACHARD	01D	L3	1992–1995 LEP runs
14.96 ±0.09 ±0.22	f&a	10.4k	AKERS	95Y	OPAL	1991–1994 LEP runs
14.22 ±0.10 ±0.37	avg		[156] BALEST	95C	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

15.26 ±0.26 ±0.22		ACTON	92H	OPAL	Repl. by AKERS 95Y
13.3 ±0.3 ±0.8		[157] ALBRECHT	92D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
14.35 $^{+0.40}_{-0.45}$ ±0.24		DECAMP	92C	ALEP	1989–1990 LEP runs

[154] The correlation coefficients between this measurement and the ABREU 01M measurements of B($\tau \to$ 1-prong) and B($\tau \to$ 5-prong) are −0.98 and −0.08 respectively.

[155] The correlation coefficients between this measurement and the ACHARD 01D measurements of B($\tau \to$ "1-prong") and B($\tau \to$ "5-prong") are −0.978 and −0.19 respectively.

[156] Not independent of BALEST 95C B($h^-h^-h^+\nu_\tau$) and B($h^-h^-h^+\pi^0\nu_\tau$) values, and BORTOLETTO 93 B($h^-h^-h^+2\pi^0\nu_\tau$)/B($h^-h^-h^+ \geq 0$ neutrals ν_τ) value.

[157] This ALBRECHT 92D value is not independent of their $\Gamma(\mu^- \overline{\nu}_\mu \nu_\tau)\Gamma(e^- \overline{\nu}_e \nu_\tau)/\Gamma^2_{\text{total}}$ value.

$\Gamma(h^- h^- h^+ \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{56}/Γ

$\Gamma_{56}/\Gamma = (0.3431\Gamma_{35}+0.3431\Gamma_{37}+\Gamma_{62}+\Gamma_{85}+\Gamma_{93}+0.017\Gamma_{144})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
9.87±0.08 OUR FIT Error includes scale factor of 1.3.						
7.6 ±0.1 ±0.5	**avg**	7.5k	[158] ALBRECHT	96E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
9.92±0.10±0.09		11.2k	[159] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
9.49±0.36±0.63			DECAMP	92C	ALEP	Repl. by SCHAEL 05C
8.7 ±0.7 ±0.3		694	[160] BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
7.0 ±0.3 ±0.7		1566	[161] BAND	87	MAC	E^{ee}_{cm}= 29 GeV
6.7 ±0.8 ±0.9			[162] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
6.4 ±0.4 ±0.9			[163] RUCKSTUHL	86	DLCO	E^{ee}_{cm}= 29 GeV
7.8 ±0.5 ±0.8		890	SCHMIDKE	86	MRK2	E^{ee}_{cm}= 29 GeV
8.4 ±0.4 ±0.7		1255	[163] FERNANDEZ	85	MAC	E^{ee}_{cm}= 29 GeV
9.7 ±2.0 ±1.3			BEHREND	84	CELL	E^{ee}_{cm}= 14,22 GeV

[158] ALBRECHT 96E not independent of ALBRECHT 93C $\Gamma(h^- h^- h^+ \nu_\tau (\text{ex. } K^0) \times \Gamma(\text{particle}^- \geq 0 \text{ neutrals } \geq 0 K^0_L \nu_\tau)/\Gamma^2_{\text{total}}$ value.

[159] BUSKULIC 96 quote B($h^- h^- h^+ \nu_\tau$ (ex. K^0)) = 9.50 ± 0.10 ± 0.11. We add 0.42 to remove their K^0 correction and reduce the systematic error accordingly.

[160] BEHREND 90 subtract 0.3% to account for the $\tau^- \rightarrow K^*(892)^- \nu_\tau$ contribution to measured events.

[161] BAND 87 subtract for charged kaon modes; not independent of FERNANDEZ 85 value.

[162] BURCHAT 87 value is not independent of SCHMIDKE 86 value.

[163] Value obtained by multiplying paper's R = B($h^- h^- h^+ \nu_\tau$)/B(3-prong) by B(3-prong) = 0.143 and subtracting 0.3% for $K^*(892)$ background.

$\Gamma(h^- h^- h^+ \nu_\tau (\text{ex.} K^0))/\Gamma_{\text{total}}$ — Γ_{57}/Γ

$\Gamma_{57}/\Gamma = (\Gamma_{62}+\Gamma_{85}+\Gamma_{93}+0.017\Gamma_{144})/\Gamma$

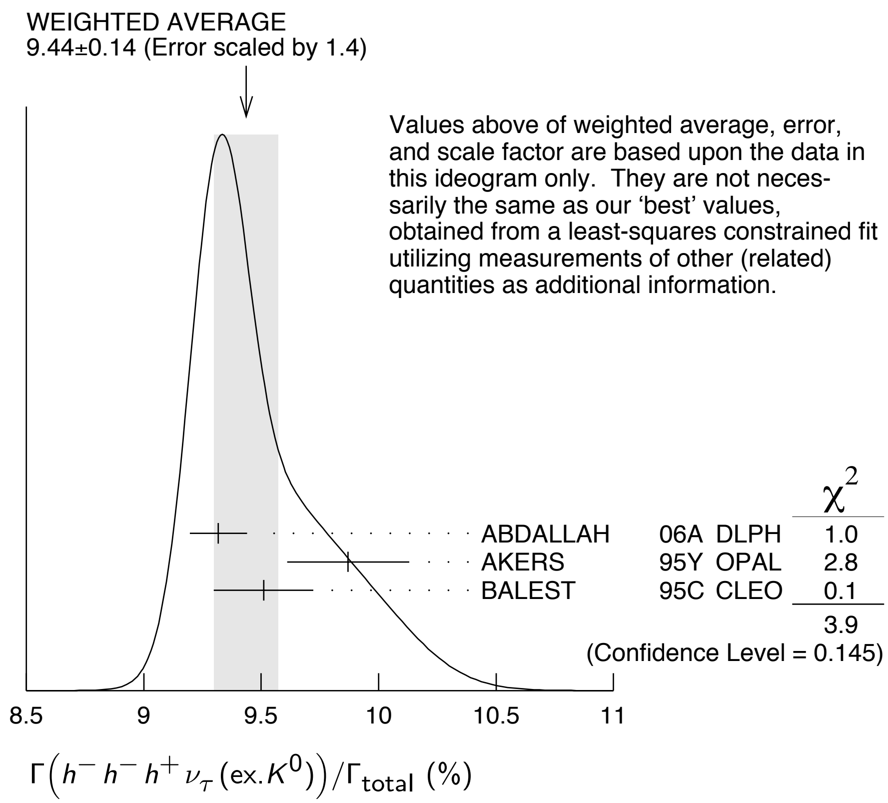
Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
9.51 ±0.08 OUR FIT Error includes scale factor of 1.3.						
9.44 ±0.14 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.						
9.317±0.090±0.082	f&a	12.2k	[164] ABDALLAH	06A	DLPH	1992–1995 LEP runs
9.87 ±0.10 ±0.24	avg		[165] AKERS	95Y	OPAL	1991–1994 LEP runs
9.51 ±0.07 ±0.20	f&a	37.7k	BALEST	95C	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
9.50 ±0.10 ±0.11		11.2k	[166] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C

164 See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{\rm total}$ measurement for correlations with other measurements.

165 Not independent of AKERS 95Y B($h^- h^- h^+ \geq 0$ neutralsν_τ (ex. $K^0_S \to \pi^+\pi^-$)) and B($h^- h^- h^+ \nu_\tau$ (ex. K^0))/B($h^- h^- h^+ \geq 0$ neutralsν_τ (ex. $K^0_S \to \pi^+\pi^-$)) values.

166 Not independent of BUSKULIC 96 B($h^- h^- h^+ \nu_\tau$) value.



$\Gamma\big(h^- h^- h^+ \nu_\tau (\text{ex.}K^0)\big)/\Gamma\big(h^- h^- h^+ \geq 0 \text{ neutrals } \nu_\tau (\text{ex. } K^0_S \to \pi^+\pi^-)$ ("3-prong")$\big)$ $\quad\Gamma_{57}/\Gamma_{55}$

$\Gamma_{57}/\Gamma_{55} = (\Gamma_{62}+\Gamma_{85}+\Gamma_{93}+0.017\Gamma_{144})/(\Gamma_{62}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.9101\Gamma_{144}+0.9101\Gamma_{146})$

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
0.652±0.004 OUR FIT	Error includes scale factor of 1.1.		
0.660±0.004±0.014	AKERS 95Y	OPAL	1991–1994 LEP runs

$\Gamma\big(h^- h^- h^+ \nu_\tau (\text{ex.}K^0,\omega)\big)/\Gamma_{\rm total}$ $\quad\Gamma_{58}/\Gamma = (\Gamma_{62}+\Gamma_{85}+\Gamma_{93})/\Gamma$

VALUE (%)	*DOCUMENT ID*
9.47±0.08 OUR FIT	Error includes scale factor of 1.3.

$\Gamma\big(\pi^- \pi^+ \pi^- \nu_\tau\big)/\Gamma_{\rm total}$ $\quad\Gamma_{59}/\Gamma = (0.3431\Gamma_{35}+\Gamma_{62}+0.017\Gamma_{144})/\Gamma$

VALUE (%)	*DOCUMENT ID*
9.33±0.08 OUR FIT	Error includes scale factor of 1.3.

$\Gamma(\pi^-\pi^+\pi^-\nu_\tau(\text{ex.}K^0))/\Gamma_{\text{total}}$ $\qquad \Gamma_{60}/\Gamma = (\Gamma_{62}+0.017\Gamma_{144})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
9.02±0.08 OUR FIT	Error includes scale factor of 1.3.				
9.13±0.05±0.46	43k	[167] BRIERE	03	CLE3	E^{ee}_{cm}= 10.6 GeV

[167] 47% correlated with BRIERE 03 $\tau^- \rightarrow K^-\pi^+\pi^-\nu_\tau$ and 71% correlated with $\tau^- \rightarrow K^-K^+\pi^-\nu_\tau$ because of a common 5% normalization error.

$\Gamma(\pi^-\pi^+\pi^-\nu_\tau(\text{ex.}K^0)\text{, non-axial vector})/\Gamma(\pi^-\pi^+\pi^-\nu_\tau(\text{ex.}K^0))$ $\qquad \Gamma_{61}/\Gamma_{60} = \Gamma_{61}/(\Gamma_{62}+0.017\Gamma_{144})$

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.261	95	[168] ACKERSTAFF	97R	OPAL	1992–1994 LEP runs

[168] Model-independent limit from structure function analysis on contribution to B($\tau^- \rightarrow \pi^-\pi^+\pi^-\nu_\tau$(ex. K^0)) from non-axial vectors.

$\Gamma(\pi^-\pi^+\pi^-\nu_\tau(\text{ex.}K^0,\omega))/\Gamma_{\text{total}}$ $\qquad \Gamma_{62}/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
8.99 ±0.08 OUR FIT	Error includes scale factor of 1.3.				
9.041±0.060±0.076	29k	[169] SCHAEL	05C	ALEP	1991-1995 LEP runs

[169] See footnote to SCHAEL 05C $\Gamma(\tau^- \rightarrow e^-\overline{\nu}_e\nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

$\Gamma(h^-h^-h^+ \geq 1\text{ neutrals }\nu_\tau)/\Gamma_{\text{total}}$ $\qquad \Gamma_{63}/\Gamma$

$\Gamma_{63}/\Gamma = (0.3431\Gamma_{40}+0.3431\Gamma_{42}+0.4307\Gamma_{47}+0.6861\Gamma_{48}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{89}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.888\Gamma_{144}+0.9101\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
5.34±0.06 OUR FIT	Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5.6 ±0.7 ±0.3	352	[170] BEHREND	90	CELL	E^{ee}_{cm}= 35 GeV
4.2 ±0.5 ±0.9	203	[171] ALBRECHT	87L	ARG	E^{ee}_{cm}= 10 GeV
6.1 ±0.8 ±0.9		[172] BURCHAT	87	MRK2	E^{ee}_{cm}= 29 GeV
7.6 ±0.4 ±0.9		[173,174] RUCKSTUHL	86	DLCO	E^{ee}_{cm}= 29 GeV
4.7 ±0.5 ±0.8	530	[175] SCHMIDKE	86	MRK2	E^{ee}_{cm}= 29 GeV
5.6 ±0.4 ±0.7		[174] FERNANDEZ	85	MAC	E^{ee}_{cm}= 29 GeV
6.2 ±2.3 ±1.7		BEHREND	84	CELL	E^{ee}_{cm}= 14,22 GeV

[170] BEHREND 90 value is not independent of BEHREND 90 B($3h\nu_\tau \geq 1$ neutrals) + B(5-prong).

[171] ALBRECHT 87L measure the product of branching ratios B($3\pi^\pm\pi^0\nu_\tau$) B($(e\overline{\nu}\,\text{or}\,\mu\overline{\nu}\,\text{or}\,\pi\,\text{or}\,K\,\text{or}\,\rho)\nu_\tau$) = 0.029 and use the PDG 86 values for the second branching ratio which sum to 0.69 ± 0.03 to get the quoted value.

[172] BURCHAT 87 value is not independent of SCHMIDKE 86 value.

[173] Contributions from kaons and from $>1\pi^0$ are subtracted. Not independent of (3-prong + $0\pi^0$) and (3-prong + $\geq 0\pi^0$) values.

[174] Value obtained using paper's R = B($h^-h^-h^+\nu_\tau$)/B(3-prong) and current B(3-prong) = 0.143.

[175] Not independent of SCHMIDKE 86 $h^-h^-h^+\nu_\tau$ and $h^-h^-h^+(\geq 0\pi^0)\nu_\tau$ values.

$\Gamma(h^- h^- h^+ \geq 1\pi^0 \nu_\tau (\text{ex. } K^0))/\Gamma_{\text{total}}$ Γ_{64}/Γ

$\Gamma_{64}/\Gamma = (\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{124}+0.226\Gamma_{126}+0.888\Gamma_{144}+0.9101\Gamma_{146})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
5.06 ±0.06 OUR FIT Error includes scale factor of 1.1.						
5.10 ±0.12 OUR AVERAGE						
5.106±0.083±0.103	avg	10.1k	[176] ABDALLAH	06A	DLPH	1992–1995 LEP runs
5.09 ±0.10 ±0.23	avg		[177] AKERS	95Y	OPAL	1991–1994 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
4.95 ±0.29 ±0.65		570	DECAMP	92C	ALEP	Repl. by SCHAEL 05C

[176] See footnote to ABDALLAH 06A $\Gamma(\tau^- \rightarrow h^- \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

[177] Not independent of AKERS 95Y B($h^- h^- h^+ \geq 0$ neutralsν_τ (ex. $K^0_S \rightarrow \pi^+\pi^-$)) and B($h^- h^- h^+ \geq 0$ neutralsν_τ (ex. K^0))/B($h^- h^- h^+ \geq 0$ neutralsν_τ (ex. $K^0_S \rightarrow \pi^+\pi^-$)) values.

$\Gamma(h^- h^- h^+ \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ Γ_{65}/Γ

$\Gamma_{65}/\Gamma = (0.3431\Gamma_{40}+0.3431\Gamma_{42}+\Gamma_{70}+\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126}+0.888\Gamma_{144}+0.017\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
4.73±0.07 OUR FIT Error includes scale factor of 1.2.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.45±0.09±0.07	6.1k	[178] BUSKULIC	96	ALEP	Repl. by SCHAEL 05C

[178] BUSKULIC 96 quote B($h^- h^- h^+ \pi^0 \nu_\tau$ (ex. K^0)) $= 4.30 \pm 0.09 \pm 0.09$. We add 0.15 to remove their K^0 correction and reduce the systematic error accordingly.

$\Gamma(h^- h^- h^+ \pi^0 \nu_\tau (\text{ex.} K^0))/\Gamma_{\text{total}}$ Γ_{66}/Γ

$\Gamma_{66}/\Gamma = (\Gamma_{70}+\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126}+0.888\Gamma_{144}+0.017\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
4.55 ±0.06 OUR FIT Error includes scale factor of 1.2.					
4.45 ±0.14 OUR AVERAGE Error includes scale factor of 1.2.					
4.545±0.106±0.103	8.9k	[179] ABDALLAH	06A	DLPH	1992–1995 LEP runs
4.23 ±0.06 ±0.22	7.2k	BALEST	95C	CLEO	$E^{ee}_{\text{cm}} \approx$ 10.6 GeV

[179] See footnote to ABDALLAH 06A $\Gamma(\tau^- \rightarrow h^- \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

$\Gamma(h^- h^- h^+ \pi^0 \nu_\tau (\text{ex. } K^0, \omega))/\Gamma_{\text{total}}$ $\Gamma_{67}/\Gamma = (\Gamma_{70}+\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126})/\Gamma$

VALUE (%)	DOCUMENT ID
2.78±0.08 OUR FIT Error includes scale factor of 1.2.	

$\Gamma(\pi^- \pi^+ \pi^- \pi^0 \nu_\tau)/\Gamma_{\text{total}}$

$\Gamma_{68}/\Gamma = (0.3431\Gamma_{40}+\Gamma_{70}+0.888\Gamma_{144}+0.017\Gamma_{146})/\Gamma$

VALUE (%)	DOCUMENT ID
4.59±0.07 OUR FIT Error includes scale factor of 1.2.	

$\Gamma\big(\pi^-\pi^+\pi^-\pi^0\nu_\tau(\text{ex.}K^0)\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{69}/\Gamma = (\Gamma_{70}+0.888\Gamma_{144}+0.017\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
4.46 ±0.06 OUR FIT Error includes scale factor of 1.2.					
4.55 ±0.13 OUR AVERAGE Error includes scale factor of 1.6.					
4.598±0.057±0.064	16k	[180] SCHAEL	05C	ALEP	1991-1995 LEP runs
4.19 ±0.10 ±0.21		[181] EDWARDS	00A	CLEO	4.7 fb^{-1} E^{ee}_{cm}= 10.6 GeV

[180] SCHAEL 05C quote (4.590 ± 0.057 ± 0.064)%. We add 0.008% to remove their correction for $\tau^- \rightarrow \pi^-\pi^0\omega\nu_\tau \rightarrow \pi^-\pi^0\pi^+\pi^-\nu_\tau$ decays. See footnote to SCHAEL 05C $\Gamma(\tau^- \rightarrow e^-\overline{\nu}_e\nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

[181] EDWARDS 00A quote (4.19 ± 0.10) × 10^{-2} with a 5% systematic error.

$\Gamma\big(\pi^-\pi^+\pi^-\pi^0\nu_\tau(\text{ex.}K^0,\omega)\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{70}/\Gamma$

VALUE (%)	DOCUMENT ID
2.69±0.08 OUR FIT Error includes scale factor of 1.2.	

$\Gamma\big(h^-\rho\pi^0\nu_\tau\big)/\Gamma\big(h^-h^-h^+\pi^0\nu_\tau\big)$ $\quad\Gamma_{71}/\Gamma_{65}$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.30±0.04±0.02	393	ALBRECHT	91D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

$\Gamma\big(h^-\rho^+h^-\nu_\tau\big)/\Gamma\big(h^-h^-h^+\pi^0\nu_\tau\big)$ $\quad\Gamma_{72}/\Gamma_{65}$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.10±0.03±0.04	142	ALBRECHT	91D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

$\Gamma\big(h^-\rho^-h^+\nu_\tau\big)/\Gamma\big(h^-h^-h^+\pi^0\nu_\tau\big)$ $\quad\Gamma_{73}/\Gamma_{65}$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.26±0.05±0.01	370	ALBRECHT	91D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

$\Gamma\big(h^-h^-h^+ \geq 2\pi^0\nu_\tau(\text{ex. }K^0)\big)/\Gamma_{\text{total}}$
$\Gamma_{74}/\Gamma = (\Gamma_{77}+\Gamma_{78}+0.226\Gamma_{124}+0.888\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.514±0.034 OUR FIT Error includes scale factor of 1.1.					
0.561±0.068±0.095	1.3k	[182] ABDALLAH	06A	DLPH	1992–1995 LEP runs

[182] See footnote to ABDALLAH 06A $\Gamma(\tau^- \rightarrow h^-\nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

$\Gamma\big(h^-h^-h^+2\pi^0\nu_\tau\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{75}/\Gamma$

$\Gamma_{75}/\Gamma = (0.4307\Gamma_{47}+\Gamma_{77}+0.226\Gamma_{124}+0.888\Gamma_{146})/\Gamma$

VALUE (%)	DOCUMENT ID
0.502±0.034 OUR FIT Error includes scale factor of 1.1.	

$\Gamma(h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ Γ_{76}/Γ

$\Gamma_{76}/\Gamma = (\Gamma_{77}+0.226\Gamma_{124}+0.888\Gamma_{146})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.492±0.034 OUR FIT	Error includes scale factor of 1.1.			
0.435±0.030±0.035	2.6k	[183] SCHAEL 05C	ALEP	1991-1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.50 ±0.07 ±0.07	1.8k	BUSKULIC 96	ALEP	Repl. by SCHAEL 05C

[183] SCHAEL 05C quote (0.392 ± 0.030 ± 0.035)%. We add 0.043% to remove their correction for $\tau^- \to \pi^- \eta \pi^0 \nu_\tau \to \pi^- \pi^+ \pi^- 2\pi^0 \nu_\tau$ and $\tau^- \to K^*(892)^- \eta \nu_\tau \to K^- \pi^+ \pi^- 2\pi^0 \nu_\tau$ decays. See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{\text{total}}$ measurement for correlations with other measurements.

$\Gamma(h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma(h^- h^- h^+ \geq 0 \text{ neutrals} \geq 0K^0_L \nu_\tau)$ Γ_{76}/Γ_{54}

$\Gamma_{76}/\Gamma_{54} = (\Gamma_{77}+0.226\Gamma_{124}+0.888\Gamma_{146})/(0.3431\Gamma_{35}+0.3431\Gamma_{37}+0.3431\Gamma_{40}+0.3431\Gamma_{42}+0.4307\Gamma_{47}+0.6861\Gamma_{48}+\Gamma_{62}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.9101\Gamma_{144}+0.9101\Gamma_{146})$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0323±0.0022 OUR FIT	Error includes scale factor of 1.1.			
0.034 ±0.002 ±0.003	668	BORTOLETTO93	CLEO	$E^{ee}_{\text{cm}} \approx 10.6$ GeV

$\Gamma(h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0,\omega,\eta))/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
9±4 OUR FIT	

$\Gamma(h^- h^- h^+ 3\pi^0 \nu_\tau)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ±0.5 OUR FIT					
2.2 ±0.3 ±0.4		139	ANASTASSOV 01	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<4.9	95		SCHAEL 05C	ALEP	1991-1995 LEP runs
2.85±0.56±0.51		57	ANDERSON 97	CLEO	Repl. by ANASTASSOV 01
11 ±4 ±5		440	[184] BUSKULIC 96	ALEP	Repl. by SCHAEL 05C

[184] BUSKULIC 96 state their measurement is for $B(h^- h^- h^+ \geq 3\pi^0 \nu_\tau)$. We assume that $B(h^- h^- h^+ \geq 4\pi^0 \nu_\tau)$ is very small.

$\Gamma(K^- h^+ h^- \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{\text{total}}$

$\Gamma_{79}/\Gamma = (0.3431\Gamma_{37}+0.3431\Gamma_{42}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{126})/\Gamma$

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
0.679±0.035 OUR FIT	Error includes scale factor of 1.3.			
<0.6	90	AIHARA 84C	TPC	E^{ee}_{cm}= 29 GeV

$\Gamma(K^- h^+ \pi^- \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ $\Gamma_{80}/\Gamma = (\Gamma_{85}+\Gamma_{93})/\Gamma$

VALUE (%)	DOCUMENT ID
0.486±0.032 OUR FIT Error includes scale factor of 1.4.	

$\Gamma\big(K^- h^+ \pi^- \nu_\tau\,(\text{ex.}K^0)\big)/\Gamma\big(\pi^- \pi^+ \pi^- \nu_\tau\,(\text{ex.}K^0)\big)$ $\Gamma_{80}/\Gamma_{60} = (\Gamma_{85}+\Gamma_{93})/(\Gamma_{62}+0.017\Gamma_{144})$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
5.4 ±0.4 OUR FIT	Error includes scale factor of 1.4.				
5.44±0.21±0.53	7.9k	RICHICHI	99	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV

$\Gamma\big(K^- h^+ \pi^- \pi^0 \nu_\tau\,(\text{ex.}K^0)\big)/\Gamma_{\text{total}}$ $\Gamma_{81}/\Gamma = (\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126})/\Gamma$

VALUE (units 10^{-4})	DOCUMENT ID
8.5±1.2 OUR FIT	

$\Gamma\big(K^- h^+ \pi^- \pi^0 \nu_\tau\,(\text{ex.}K^0)\big)/\Gamma\big(\pi^- \pi^+ \pi^- \pi^0 \nu_\tau\,(\text{ex.}K^0)\big)$ $\Gamma_{81}/\Gamma_{69} = (\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126})/(\Gamma_{70}+0.888\Gamma_{144}+0.017\Gamma_{146})$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.91±0.27 OUR FIT					
2.61±0.45±0.42	719	RICHICHI	99	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV

$\Gamma\big(K^- \pi^+ \pi^- \geq 0\ \text{neutrals}\ \nu_\tau\big)/\Gamma_{\text{total}}$ $\Gamma_{82}/\Gamma = (0.3431\Gamma_{37}+0.3431\Gamma_{42}+\Gamma_{85}+\Gamma_{89}+0.285\Gamma_{126})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.52±0.04 OUR FIT	Error includes scale factor of 1.5.				
$0.58^{+0.15}_{-0.13}$±0.12	20	[185] BAUER	94	TPC	$E^{ee}_{\rm cm}$= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.22^{+0.16}_{-0.13}$±0.05	9	[186] MILLS	85	DLCO	$E^{ee}_{\rm cm}$= 29 GeV

[185] We multiply 0.58% by 0.20, the relative systematic error quoted by BAUER 94, to obtain the systematic error.

[186] Error correlated with MILLS 85 ($K K \pi \nu$) value. We multiply 0.22% by 0.23, the relative systematic error quoted by MILLS 85, to obtain the systematic error.

$\Gamma\big(K^- \pi^+ \pi^- \geq 0\pi^0 \nu_\tau\,(\text{ex.}K^0)\big)/\Gamma_{\text{total}}$ $\Gamma_{83}/\Gamma = (\Gamma_{85}+\Gamma_{89}+0.226\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		DOCUMENT ID		TECN	COMMENT
0.41 ±0.04 OUR FIT	Error includes scale factor of 1.5.				
0.30 ±0.05 OUR AVERAGE					
0.343±0.073±0.031	avg	ABBIENDI	00D	OPAL	1990–1995 LEP runs
0.275±0.064	avg	[187] BARATE	98	ALEP	1991–1995 LEP runs

[187] Not independent of BARATE 98 $\Gamma(\tau^- \to K^- \pi^+ \pi^- \nu_\tau)/\Gamma_{\text{total}}$ and $\Gamma(\tau^- \to K^- \pi^+ \pi^- \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ values.

$\Gamma\big(K^- \pi^+ \pi^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\Gamma_{84}/\Gamma = (0.3431\Gamma_{37}+\Gamma_{85})/\Gamma$

VALUE (%)	DOCUMENT ID
0.39±0.04 OUR FIT Error includes scale factor of 1.6.	

$\Gamma(K^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ Γ_{85}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

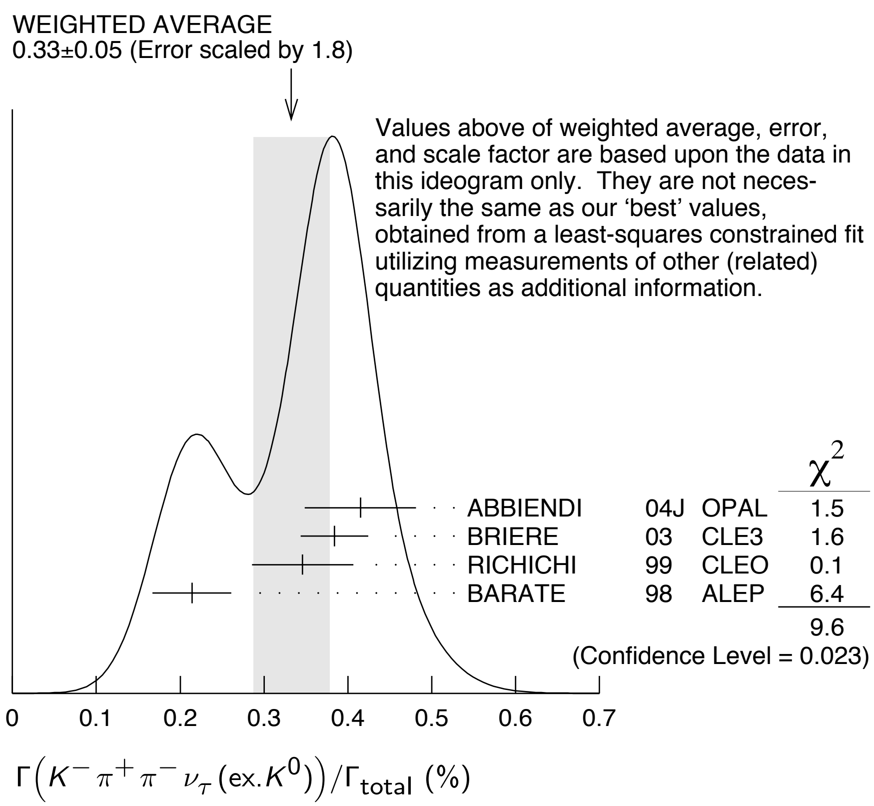
VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.333±0.035 OUR FIT	Error includes scale factor of 1.6.					
0.33 ±0.05 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.					
0.415±0.053±0.040	f&a	269	ABBIENDI	04J	OPAL	1991-1995 LEP runs
0.384±0.014±0.038	f&a	3.5k	[188] BRIERE	03	CLE3	E^{ee}_{cm}= 10.6 GeV
0.346±0.023±0.056	avg	158	[189] RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV
0.214±0.037±0.029	f&a		BARATE	98	ALEP	1991–1995 LEP runs

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.360±0.082±0.048			ABBIENDI	00D	OPAL	1990–1995 LEP runs

[188] 47% correlated with BRIERE 03 $\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau$ and 34% correlated with $\tau^- \rightarrow K^- K^+ \pi^- \nu_\tau$ because of a common 5% normalization error.

[189] Not independent of RICHICHI 99 $\Gamma(\tau^- \rightarrow K^- h^+ \pi^- \nu_\tau (\text{ex.}K^0))/\Gamma(\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$, $\Gamma(\tau^- \rightarrow K^- K^+ \pi^- \nu_\tau)/\Gamma(\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$ and BALEST 95C $\Gamma(\tau^- \rightarrow h^- h^- h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ values.



$\Gamma(K^- \rho^0 \nu_\tau \to K^- \pi^+ \pi^- \nu_\tau)/\Gamma(K^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$ Γ_{86}/Γ_{85}

VALUE	DOCUMENT ID		TECN	COMMENT
0.48±0.14±0.10	[190] ASNER	00B	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.39±0.14	[191] BARATE	99R	ALEP	1991–1995 LEP runs

[190] ASNER 00B assume $\tau^- \to K^- \pi^+ \pi^- \nu_\tau$ (ex. K^0) decays proceed only through $K\rho$ and $K^* \pi$ intermediate states. They assume the resonance structure of $\tau^- \to K^- \pi^+ \pi^- \nu_\tau$ (ex. K^0) decays is dominated by $K_1(1270)^-$ and $K_1(1400)^-$ resonances, and assume B($K_1(1270) \to K^*(892)\pi$) = (16 ± 5)%, B($K_1(1270) \to K\rho$) = (42 ± 6)%, and B($K_1(1400) \to K\rho$) = 0.

[191] BARATE 99R assume $\tau^- \to K^- \pi^+ \pi^- \nu_\tau$ (ex. K^0) decays proceed only through $K\rho$ and $K^* \pi$ intermediate states. The quoted error is statistical only.

$\Gamma(K^- \pi^+ \pi^- \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ $\Gamma_{87}/\Gamma = (0.3431\Gamma_{42}+\Gamma_{89}+0.226\Gamma_{126})/\Gamma$

VALUE (units 10^{-4})	DOCUMENT ID
13.2±1.4 OUR FIT	

$\Gamma(K^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ $\Gamma_{88}/\Gamma = (\Gamma_{89}+0.226\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (units 10^{-4})		CL%	DOCUMENT ID		TECN	COMMENT
7.9±1.2 OUR FIT						
7.3±1.2 OUR AVERAGE						
7.4±0.8±1.1	f&a		[192] ARMS	05	CLE3	7.6 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
7.5±2.6±1.8	avg		[193] RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV
6.1±3.9±1.8	f&a		BARATE	98	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<17		95	ABBIENDI	00D	OPAL	1990–1995 LEP runs

[192] Not independent of ARMS 05 $\Gamma(\tau^- \to K^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex.}K^0,\omega))$ / Γ_{total} and $\Gamma(\tau^- \to K^- \omega \nu_\tau)$ / Γ_{total} values.

[193] Not independent of RICHICHI 99 $\Gamma(\tau^- \to K^- h^+ \pi^- \nu_\tau (\text{ex.}K^0))/\Gamma(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$, $\Gamma(\tau^- \to K^- K^+ \pi^- \nu_\tau)/\Gamma(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$ and BALEST 95C $\Gamma(\tau^- \to h^- h^- h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ values.

$\Gamma(K^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex.}K^0,\eta))/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
7.3±1.2 OUR FIT	

$\Gamma(K^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex.}K^0,\omega))/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
3.7±0.5±0.8	833	ARMS	05	CLE3	7.6 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(K^- \pi^+ K^- \geq 0\,\text{neut.}\ \nu_\tau)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.09	95	BAUER	94	TPC	E^{ee}_{cm}= 29 GeV

$\Gamma(K^- K^+ \pi^- \geq 0\,\text{neut.}\ \nu_\tau)/\Gamma_{\text{total}}$ $\Gamma_{92}/\Gamma = (\Gamma_{93}+\Gamma_{94})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.159±0.010 OUR FIT Error includes scale factor of 1.4.						
0.203±0.031 OUR AVERAGE						
0.159±0.053±0.020	f&a		ABBIENDI	00D	OPAL	1990–1995 LEP runs
0.238±0.042	avg		[194] BARATE	98	ALEP	1991–1995 LEP runs
$0.15\ ^{+0.09}_{-0.07}\ \pm0.03$	f&a	4	[195] BAUER	94	TPC	E^{ee}_{cm}= 29 GeV

[194] Not independent of BARATE 98 $\Gamma(\tau^- \to K^- K^+ \pi^- \nu_\tau)/\Gamma_{\text{total}}$ and $\Gamma(\tau^- \to K^- K^+ \pi^- \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ values.

[195] We multiply 0.15% by 0.20, the relative systematic error quoted by BAUER 94, to obtain the systematic error.

$\Gamma(K^- K^+ \pi^- \nu_\tau)/\Gamma_{\text{total}}$ Γ_{93}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.153±0.010 OUR FIT Error includes scale factor of 1.4.						
0.154±0.009 OUR AVERAGE						
0.155±0.006±0.009	f&a	932	[196] BRIERE	03	CLE3	E^{ee}_{cm}= 10.6 GeV
0.087±0.056±0.040	avg		ABBIENDI	00D	OPAL	1990–1995 LEP runs
0.145±0.013±0.028	avg	2.3k	[197] RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV
0.163±0.021±0.017	f&a		BARATE	98	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$0.22\ ^{+0.17}_{-0.11}\ \pm0.05$		9	[198] MILLS	85	DLCO	E^{ee}_{cm}= 29 GeV

[196] 71% correlated with BRIERE 03 $\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau$ and 34% correlated with $\tau \to K^- \pi^+ \pi^- \nu_\tau$ because of a common 5% normalization error.

[197] Not independent of RICHICHI 99 $\Gamma(\tau^- \to K^- K^+ \pi^- \nu_\tau)/\ \Gamma(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$ and BALEST 95C $\Gamma(\tau^- \to h^- h^- h^+ \nu_\tau (\text{ex.}K^0))/\Gamma_{\text{total}}$ values.

[198] Error correlated with MILLS 85 ($K\pi\pi\pi^0\nu$) value. We multiply 0.22% by 0.23, the relative systematic error quoted by MILLS 85, to obtain the systematic error.

$\Gamma(K^- K^+ \pi^- \nu_\tau)/\Gamma(\pi^- \pi^+ \pi^- \nu_\tau (\text{ex.}K^0))$ $\Gamma_{93}/\Gamma_{60} = \Gamma_{93}/(\Gamma_{62}+0.017\Gamma_{144})$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.70±0.11 OUR FIT Error includes scale factor of 1.4.					
1.60±0.15±0.30	2.3k	RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(K^- K^+ \pi^- \pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{94}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (units 10^{-4})		CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.61±0.20 OUR FIT	Error includes scale factor of 1.1.						
0.60±0.18 OUR AVERAGE							
0.55±0.14±0.12	f&a		48	ARMS	05	CLE3	7.6 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
3.3 ±1.8 ±0.7	avg		158	[199] RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV
7.5 ±2.9 ±1.5	f&a			BARATE	98	ALEP	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<27		95		ABBIENDI	00D	OPAL	1990–1995 LEP runs

[199] Not independent of RICHICHI 99 $\Gamma(\tau^- \to K^- K^+ \pi^- \nu_\tau)/\Gamma(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau (\text{ex}.K^0))$ and BALEST 95C $\Gamma(\tau^- \to h^- h^- h^+ \nu_\tau (\text{ex}.K^0))/\Gamma_{total}$ values.

$\Gamma(K^- K^+ \pi^- \pi^0 \nu_\tau)/\Gamma(\pi^- \pi^+ \pi^- \pi^0 \nu_\tau (\text{ex}.K^0))$

$\Gamma_{94}/\Gamma_{69} = \Gamma_{94}/(\Gamma_{70}+0.888\Gamma_{144}+0.017\Gamma_{146})$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.14±0.04 OUR FIT	Error includes scale factor of 1.1.				
0.79±0.44±0.16	158	[200] RICHICHI	99	CLEO	E^{ee}_{cm}= 10.6 GeV

[200] RICHICHI 99 also quote a 95%CL upper limit of 0.0157 for this measurement.

$\Gamma(K^- K^+ K^- \geq 0\,\text{neut.}\ \nu_\tau)/\Gamma_{total}$ Γ_{95}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.21	95	BAUER	94	TPC	E^{ee}_{cm}= 29 GeV

$\Gamma(K^- K^+ K^- \nu_\tau)/\Gamma_{total}$ Γ_{96}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.7 × 10^{-5}	90	BRIERE	03	CLE3	E^{ee}_{cm}= 10.6 GeV
<1.9 × 10^{-4}	90	BARATE	98	ALEP	1991–1995 LEP runs

$\Gamma(K^- K^+ K^- \pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{97}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.8 × 10^{-6}	90	ARMS	05	CLE3	7.6 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(\pi^- K^+ \pi^- \geq 0\,\text{neut.}\ \nu_\tau)/\Gamma_{total}$ Γ_{98}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.25	95	BAUER	94	TPC	E^{ee}_{cm}= 29 GeV

$\Gamma(e^- e^- e^+ \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ Γ_{99}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.8±1.4±0.4	5	ALAM	96	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- e^- e^+ \overline{\nu}_\mu \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{100}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<3.6	90	ALAM	96	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(3h^- 2h^+ \geq 0 \text{ neutrals } \nu_\tau (\text{ex. } K^0_S \to \pi^-\pi^+)(\text{“5-prong”}))/\Gamma_{\text{total}}$ — Γ_{101}/Γ

Data marked “avg” are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. “f&a” marks results used for the fit and the average. $\Gamma_{101}/\Gamma = (\Gamma_{102}+\Gamma_{103})/\Gamma$

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
0.102±0.004 OUR FIT Error includes scale factor of 1.1.						
0.107±0.007 OUR AVERAGE Error includes scale factor of 1.1.						
0.093±0.009±0.012	avg		SCHAEL	05C	ALEP	1991-1995 LEP runs
0.115±0.013±0.006	avg	112	[201] ABREU	01M	DLPH	1992–1995 LEP runs
0.170±0.022±0.026	f&a		[202] ACHARD	01D	L3	1992–1995 LEP runs
0.119±0.013±0.008	avg	119	[203] ACKERSTAFF	99E	OPAL	1991–1995 LEP runs
0.097±0.005±0.011	f&a	419	GIBAUT	94B	CLEO	E^{ee}_{cm}= 10.6 GeV
0.102±0.029	f&a	13	BYLSMA	87	HRS	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.26 ±0.06 ±0.05			ACTON	92H	OPAL	E^{ee}_{cm}= 88.2–94.2 GeV
0.10 $^{+0.05}_{-0.04}$ ±0.03			DECAMP	92C	ALEP	1989–1990 LEP runs
0.16 ±0.13 ±0.04			BEHREND	89B	CELL	E^{ee}_{cm}= 14–47 GeV
0.3 ±0.1 ±0.2			BARTEL	85F	JADE	E^{ee}_{cm}= 34.6 GeV
0.13 ±0.04		10	BELTRAMI	85	HRS	Repl. by BYLSMA 87
0.16 ±0.08 ±0.04		4	BURCHAT	85	MRK2	E^{ee}_{cm}= 29 GeV
1.0 ±0.4		10	BEHREND	82	CELL	Repl. by BEHREND 89B

[201] The correlation coefficients between this measurement and the ABREU 01M measurements of B($\tau \to$ 1-prong) and B($\tau \to$ 3-prong) are −0.08 and −0.08 respectively.

[202] The correlation coefficients between this measurement and the ACHARD 01D measurements of B($\tau \to$ “1-prong”) and B($\tau \to$ “3-prong”) are −0.082 and −0.19 respectively.

[203] Not independent of ACKERSTAFF 99E B($\tau^- \to 3h^- 2h^+ \nu_\tau$(ex. K^0)) and B($\tau^- \to 3h^- 2h^+ \pi^0 \nu_\tau$(ex. K^0)) measurements.

$\Gamma(3h^- 2h^+ \nu_\tau (\text{ex.} K^0))/\Gamma_{\text{total}}$ — Γ_{102}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
8.38±0.35 OUR FIT Error includes scale factor of 1.1.					
8.32±0.35 OUR AVERAGE					
9.7 ±1.5 ±0.5	96	[204] ABDALLAH	06A	DLPH	1992–1995 LEP runs
8.56±0.05±0.42	34k	AUBERT,B	05W	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
7.2 ±0.9 ±1.2	165	[205] SCHAEL	05C	ALEP	1991-1995 LEP runs
9.1 ±1.4 ±0.6	97	ACKERSTAFF	99E	OPAL	1991–1995 LEP runs
7.7 ±0.5 ±0.9	295	GIBAUT	94B	CLEO	E^{ee}_{cm}= 10.6 GeV
6.4 ±2.3 ±1.0	12	ALBRECHT	88B	ARG	E^{ee}_{cm}= 10 GeV
5.1 ±2.0	7	BYLSMA	87	HRS	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					

8.0 ±1.1 ±1.3	58		BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
6.7 ±3.0	5	[206]	BELTRAMI	85	HRS	Repl. by BYLSMA 87

[204] See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[205] See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[206] The error quoted is statistical only.

$\Gamma(3h^- 2h^+ \pi^0 \nu_\tau (\text{ex.}K^0))/\Gamma_{total}$ Γ_{103}/Γ

VALUE (units 10^{-4})	EVTS		DOCUMENT ID		TECN	COMMENT
1.78±0.27 OUR FIT						
1.74±0.27 OUR AVERAGE						
1.6 ±1.2 ±0.6	13	[207]	ABDALLAH	06A	DLPH	1992–1995 LEP runs
2.1 ±0.7 ±0.9	95	[208]	SCHAEL	05C	ALEP	1991-1995 LEP runs
1.7 ±0.2 ±0.2	231		ANASTASSOV	01	CLEO	E^{ee}_{cm}= 10.6 GeV
2.7 ±1.8 ±0.9	23		ACKERSTAFF	99E	OPAL	1991–1995 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.8 ±0.7 ±1.2	18		BUSKULIC	96	ALEP	Repl. by SCHAEL 05C
1.9 ±0.4 ±0.4	31		GIBAUT	94B	CLEO	Repl. by ANASTASSOV 01
5.1 ±2.2	6		BYLSMA	87	HRS	E^{ee}_{cm}= 29 GeV
6.7 ±3.0	5	[209]	BELTRAMI	85	HRS	Repl. by BYLSMA 87

[207] See footnote to ABDALLAH 06A $\Gamma(\tau^- \to h^- \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[208] SCHAEL 05C quote $(1.4 \pm 0.7 \pm 0.9) \times 10^{-4}$. We add 0.7×10^{-4} to remove their correction for $\tau^- \to \eta\pi^-\pi^+\pi^-\nu_\tau \to 3\pi^- 2\pi^+ \pi^0 \nu_\tau$ and $\tau^- \to K^*(892)^- \eta \nu_\tau \to 3\pi^- 2\pi^+ \pi^0 \nu_\tau$ decays. See footnote to SCHAEL 05C $\Gamma(\tau^- \to e^- \overline{\nu}_e \nu_\tau)/\Gamma_{total}$ measurement for correlations with other measurements.

[209] The error quoted is statistical only.

$\Gamma(3h^- 2h^+ 2\pi^0 \nu_\tau)/\Gamma_{total}$ Γ_{104}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.011	90	GIBAUT	94B	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma((5\pi)^- \nu_\tau)/\Gamma_{total}$ Γ_{105}/Γ

$\Gamma_{105}/\Gamma = (\Gamma_{30}+\Gamma_{47}+\Gamma_{77}+\Gamma_{102}+0.553\Gamma_{124}+0.888\Gamma_{146})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)			DOCUMENT ID		TECN	COMMENT
0.76±0.05 OUR FIT Error includes scale factor of 1.1.						
0.61±0.06±0.08	**avg**	[210]	GIBAUT	94B	CLEO	E^{ee}_{cm}= 10.6 GeV

[210] Not independent of GIBAUT 94B B($3h^- 2h^+ \nu_\tau$), PROCARIO 93 B($h^- 4\pi^0 \nu_\tau$), and BORTOLETTO 93 B($2h^- h^+ 2\pi^0 \nu_\tau$)/B("3prong") measurements. Result is corrected for η contributions.

$\Gamma(4h^- 3h^+ \geq 0 \text{ neutrals } \nu_\tau \text{ ("7-prong")})/\Gamma_{\text{total}}$ — Γ_{106}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.0 × 10^{-7}	90	AUBERT,B	05F	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.8 \times 10^{-5}$	95	ACKERSTAFF	97J	OPAL	1990–1995 LEP runs
$<2.4 \times 10^{-6}$	90	EDWARDS	97B	CLEO	E^{ee}_{cm}= 10.6 GeV
$<2.9 \times 10^{-4}$	90	BYLSMA	87	HRS	E^{ee}_{cm}= 29 GeV

$\Gamma(4h^- 3h^+ \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{107}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.3 × 10^{-7}	90	AUBERT,B	05F	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(4h^- 3h^+ \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{108}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.5 × 10^{-7}	90	AUBERT,B	05F	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(X^-(S{=}-1)\nu_\tau)/\Gamma_{\text{total}}$

$\Gamma_{109}/\Gamma = (\Gamma_{10}+\Gamma_{16}+\Gamma_{23}+\Gamma_{28}+\Gamma_{35}+\Gamma_{40}+\Gamma_{85}+\Gamma_{89}+\Gamma_{126})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		DOCUMENT ID		TECN	COMMENT
2.95±0.07 OUR FIT	Error includes scale factor of 1.1.				
2.87±0.12	**avg**	[211] BARATE	99R	ALEP	1991–1995 LEP runs

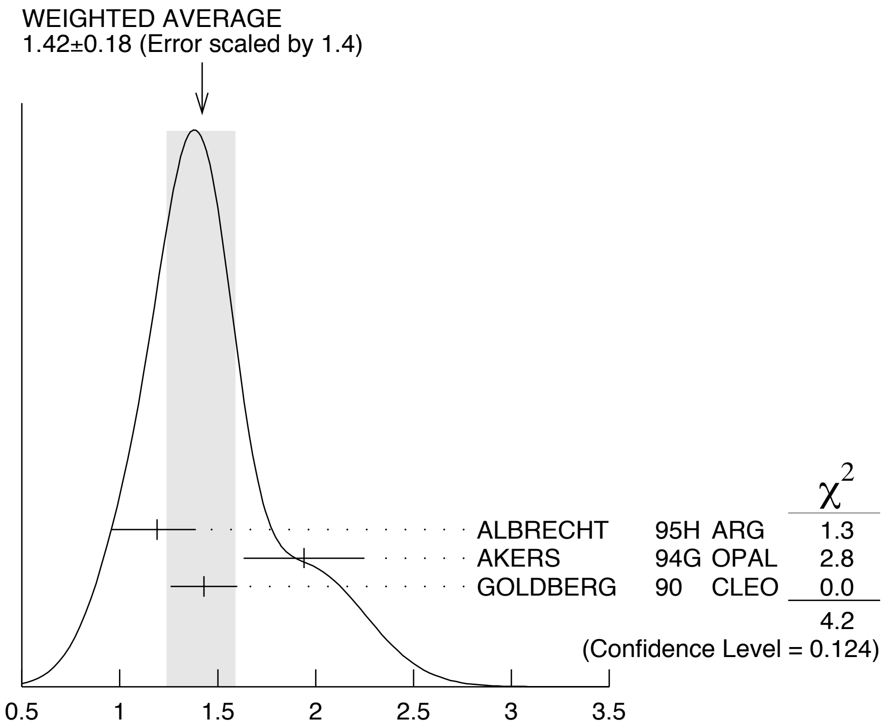
[211] BARATE 99R perform a combined analysis of all ALEPH LEP 1 data on τ branching fraction measurements for decay modes having total strangeness equal to -1.

$\Gamma(K^*(892)^- \geq 0 \text{ neutrals } \geq 0 K^0_L \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{110}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.42±0.18 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.				
$1.19 \pm 0.15 ^{+0.13}_{-0.18}$	104	ALBRECHT	95H	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
$1.94 \pm 0.27 \pm 0.15$	74	[212] AKERS	94G	OPAL	E^{ee}_{cm}= 88–94 GeV
$1.43 \pm 0.11 \pm 0.13$	475	[213] GOLDBERG	90	CLEO	E^{ee}_{cm}= 9.4–10.9 GeV

[212] AKERS 94G reject events in which a K^0_S accompanies the $K^*(892)^-$. We do not correct for them.

[213] GOLDBERG 90 estimates that 10% of observed $K^*(892)$ are accompanied by a π^0.



$\Gamma\Big(K^*(892)^- \geq 0\,\text{neutrals} \geq 0K^0_L\nu_\tau\Big)/\Gamma_{\text{total}}$ Γ_{110}/Γ

$\Gamma\big(K^*(892)^-\nu_\tau\big)/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE (%)			EVTS	DOCUMENT ID		TECN	COMMENT
1.29	**±0.05**	**OUR AVERAGE**					
1.326	±0.063			BARATE	99R	ALEP	1991–1995 LEP runs
1.11	±0.12			[214] COAN	96	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
1.42	±0.22	±0.09		[215] ACCIARRI	95F	L3	1991–1993 LEP runs
1.23	±0.21	$^{+0.11}_{-0.21}$	54	[216] ALBRECHT	88L	ARG	E^{ee}_{cm}= 10 GeV
1.9	±0.3	±0.4	44	[217] TSCHIRHART	88	HRS	E^{ee}_{cm}= 29 GeV
1.5	±0.4	±0.4	15	[218] AIHARA	87C	TPC	E^{ee}_{cm}= 29 GeV
1.3	±0.3	±0.3	31	YELTON	86	MRK2	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •							
1.39	±0.09	±0.10		[219] BUSKULIC	96	ALEP	Repl. by BARATE 99R
1.45	±0.13	±0.11	273	[220] BUSKULIC	94F	ALEP	Repl. by BUSKULIC 96
1.7	±0.7		11	DORFAN	81	MRK2	E^{ee}_{cm}= 4.2–6.7 GeV

[214] Not independent of COAN 96 B($\pi^-\overline{K}^0\nu_\tau$) and BATTLE 94 B($K^-\pi^0\nu_\tau$) measurements. $K\pi$ final states are consistent with and assumed to originate from $K^*(892)^-$ production.

[215] This result is obtained from their B($\pi^-\overline{K}^0\nu_\tau$) assuming all those decays originate in $K^*(892)^-$ decays.

[216] The authors divide by $\Gamma_2/\Gamma = 0.865$ to obtain this result.

[217] Not independent of TSCHIRHART 88 $\Gamma(\tau^- \rightarrow h^-\overline{K}^0 \geq 0$ neutrals $\geq 0K^0_L\nu_\tau)/\Gamma$(total).

[218] Decay π^- identified in this experiment, is assumed in the others.

[219] Not independent of BUSKULIC 96 B($\pi^-\overline{K}^0\nu_\tau$) and B($K^-\pi^0\nu_\tau$) measurements.

[220] BUSKULIC 94F obtain this result from BUSKULIC 94F B($\overline{K}^0 \pi^- \nu_\tau$) and BUSKULIC 94E B($K^- \pi^0 \nu_\tau$) assuming all of those decays originate in $K^*(892)^-$ decays.

$\Gamma(K^*(892)^- \nu_\tau)/\Gamma(\pi^- \pi^0 \nu_\tau)$ — Γ_{111}/Γ_{14}

VALUE	DOCUMENT ID		TECN	COMMENT
0.075±0.027	[221] ABREU	94K	DLPH	LEP 1992 Z data

[221] ABREU 94K quote B($\tau^- \rightarrow K^*(892)^- \nu_\tau$)B($K^*(892)^- \rightarrow K^- \pi^0$)/B($\tau^- \rightarrow \rho^- \nu_\tau$) = 0.025 ± 0.009. We divide by B($K^*(892)^- \rightarrow K^- \pi^0$) = 0.333 to obtain this result.

$\Gamma(K^*(892)^0 K^- \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{112}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.32±0.08±0.12	119	GOLDBERG	90	CLEO	E^{ee}_{cm}= 9.4–10.9 GeV

$\Gamma(K^*(892)^0 K^- \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{113}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.21 ±0.04 OUR AVERAGE					
0.213±0.048		[222] BARATE	98	ALEP	1991–1995 LEP runs
0.20 ±0.05 ±0.04	47	ALBRECHT	95H	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[222] BARATE 98 measure the K^- ($\rho^0 \rightarrow \pi^+ \pi^-$) fraction in $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$ decays to be (35 ± 11)% and derive this result from their measurement of $\Gamma(\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau)/\Gamma_{\text{total}}$ assuming the intermediate states are all $K^- \rho$ and $K^- K^*(892)^0$.

$\Gamma(\overline{K}^*(892)^0 \pi^- \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{114}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.38±0.11±0.13	105	GOLDBERG	90	CLEO	E^{ee}_{cm}= 9.4–10.9 GeV

$\Gamma(\overline{K}^*(892)^0 \pi^- \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{115}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.22 ±0.05 OUR AVERAGE					
0.209±0.058		[223] BARATE	98	ALEP	1991–1995 LEP runs
0.25 ±0.10 ±0.05	27	ALBRECHT	95H	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[223] BARATE 98 measure the $K^- K^*(892)^0$ fraction in $\tau^- \rightarrow K^- K^+ \pi^- \nu_\tau$ decays to be (87 ± 13)% and derive this result from their measurement of $\Gamma(\tau^- \rightarrow K^- K^+ \pi^- \nu_\tau)/\Gamma_{\text{total}}$.

$\Gamma((\overline{K}^*(892)\pi)^- \nu_\tau \rightarrow \pi^- \overline{K}^0 \pi^0 \nu_\tau)/\Gamma_{\text{total}}$ — Γ_{116}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.10 ±0.04 OUR AVERAGE				
0.097±0.044±0.036	[224] BARATE	99K	ALEP	1991–1995 LEP runs
0.106±0.037±0.032	[225] BARATE	98E	ALEP	1991–1995 LEP runs

[224] BARATE 99K measure K^0's by detecting K^0_L's in their hadron calorimeter. They determine the $\overline{K}^0 \rho^-$ fraction in $\tau^- \rightarrow \pi^- \overline{K}^0 \pi^0 \nu_\tau$ decays to be (0.72 ± 0.12 ± 0.10) and multiply their B($\pi^- \overline{K}^0 \pi^0 \nu_\tau$) measurement by one minus this fraction to obtain the quoted result.

[225] BARATE 98E reconstruct K^0's using $K^0_S \rightarrow \pi^+ \pi^-$ decays. They determine the $\overline{K}^0 \rho^-$ fraction in $\tau^- \rightarrow \pi^- \overline{K}^0 \pi^0 \nu_\tau$ decays to be (0.64 ± 0.09 ± 0.10) and multiply their B($\pi^- \overline{K}^0 \pi^0 \nu_\tau$) measurement by one minus this fraction to obtain the quoted result.

$\Gamma\big(K_1(1270)^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{117}/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.47±0.11 OUR AVERAGE					
0.48±0.11		BARATE	99R	ALEP	1991–1995 LEP runs
$0.41^{+0.41}_{-0.35}\pm0.10$	5	[226] BAUER	94	TPC	$E^{ee}_{\rm cm}$= 29 GeV

[226] We multiply 0.41% by 0.25, the relative systematic error quoted by BAUER 94, to obtain the systematic error.

$\Gamma\big(K_1(1400)^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{118}/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.17±0.26 OUR AVERAGE	Error includes scale factor of 1.7.				
0.05±0.17		BARATE	99R	ALEP	1991–1995 LEP runs
$0.76^{+0.40}_{-0.33}\pm0.20$	11	[227] BAUER	94	TPC	$E^{ee}_{\rm cm}$= 29 GeV

[227] We multiply 0.76% by 0.25, the relative systematic error quoted by BAUER 94, to obtain the systematic error.

$\big[\Gamma\big(K_1(1270)^- \nu_\tau\big)+\Gamma\big(K_1(1400)^- \nu_\tau\big)\big]/\Gamma_{\text{total}}$ $\quad(\Gamma_{117}+\Gamma_{118})/\Gamma$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.17^{+0.41}_{-0.37}\pm0.29}$	16	[228] BAUER	94	TPC	$E^{ee}_{\rm cm}$= 29 GeV

[228] We multiply 1.17% by 0.25, the relative systematic error quoted by BAUER 94, to obtain the systematic error. Not independent of BAUER 94 B($K_1(1270)^- \nu_\tau$) and BAUER 94 B($K_1(1400)^- \nu_\tau$) measurements.

$\Gamma\big(K_1(1270)^- \nu_\tau\big)/\big[\Gamma\big(K_1(1270)^- \nu_\tau\big)+\Gamma\big(K_1(1400)^- \nu_\tau\big)\big]$ $\quad\Gamma_{117}/(\Gamma_{117}+\Gamma_{118})$

VALUE	DOCUMENT ID		TECN	COMMENT
0.69±0.15 OUR AVERAGE				
0.71±0.16±0.11	[229] ABBIENDI	00D	OPAL	1990–1995 LEP runs
0.66±0.19±0.13	[230] ASNER	00B	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV

[229] ABBIENDI 00D assume the resonance structure of $\tau^- \rightarrow K^-\pi^+\pi^-\nu_\tau$ decays is dominated by the $K_1(1270)^-$ and $K_1(1400)^-$ resonances.

[230] ASNER 00B assume the resonance structure of $\tau^- \rightarrow K^-\pi^+\pi^-\nu_\tau$ (ex. K^0) decays is dominated by $K_1(1270)^-$ and $K_1(1400)^-$ resonances.

$\Gamma\big(K^*(1410)^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{119}/\Gamma$

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.5^{+1.4}_{-1.0}}$	BARATE	99R	ALEP	1991–1995 LEP runs

$\Gamma\big(K_0^*(1430)^- \nu_\tau\big)/\Gamma_{\text{total}}$ $\quad\Gamma_{120}/\Gamma$

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<0.5	95	BARATE	99R	ALEP	1991–1995 LEP runs

$\Gamma(K_2^*(1430)^-\nu_\tau)/\Gamma_{total}$ — Γ_{121}/Γ

VALUE (%)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.3	95		TSCHIRHART	88	HRS	E^{ee}_{cm}= 29 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.33	95		[231] ACCIARRI	95F	L3	1991–1993 LEP runs
<0.9	95	0	DORFAN	81	MRK2	E^{ee}_{cm}= 4.2–6.7 GeV

[231] ACCIARRI 95F quote B($\tau^- \rightarrow K^*(1430)^- \rightarrow \pi^- \overline{K}^0 \nu_\tau$) < 0.11%. We divide by B($K^*(1430)^- \rightarrow \pi^- \overline{K}^0$) = 0.33 to obtain the limit shown.

$\Gamma(a_0(980)^- \geq 0\text{ neutrals }\nu_\tau)/\Gamma_{total} \times B(a_0(980) \rightarrow K^0 K^-)$ — $\Gamma_{122}/\Gamma \times B$

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.8	90	GOLDBERG	90	CLEO	E^{ee}_{cm}= 9.4–10.9 GeV

$\Gamma(\eta\pi^-\nu_\tau)/\Gamma_{total}$ — Γ_{123}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 1.4	95	0	BARTELT	96	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 6.2	95		BUSKULIC	97C	ALEP	1991–1994 LEP runs
< 3.4	95		ARTUSO	92	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
< 90	95		ALBRECHT	88M	ARG	$E^{ee}_{cm} \approx$ 10 GeV
<140	90		BEHREND	88	CELL	E^{ee}_{cm}= 14–46.8 GeV
<180	95		BARINGER	87	CLEO	E^{ee}_{cm}= 10.5 GeV
<250	90	0	COFFMAN	87	MRK3	E^{ee}_{cm}= 3.77 GeV
510 ±100±120		65	DERRICK	87	HRS	E^{ee}_{cm}= 29 GeV
<100	95		GAN	87B	MRK2	E^{ee}_{cm}= 29 GeV

$\Gamma(\eta\pi^-\pi^0\nu_\tau)/\Gamma_{total}$ — Γ_{124}/Γ

VALUE (%)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.177±0.024 OUR FIT						
0.173±0.024 OUR AVERAGE						
0.18 ±0.04 ±0.02			BUSKULIC	97C	ALEP	1991–1994 LEP runs
0.17 ±0.02 ±0.02		125	ARTUSO	92	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.10	95		ALBRECHT	88M	ARG	$E^{ee}_{cm} \approx$ 10 GeV
<2.10	95		BARINGER	87	CLEO	E^{ee}_{cm}= 10.5 GeV
4.20 $^{+0.70}_{-1.20}$ ±1.60			[232] GAN	87	MRK2	E^{ee}_{cm}= 29 GeV

[232] Highly correlated with GAN 87 $\Gamma(\pi^- 3\pi^0 \nu_\tau)/\Gamma(\text{total})$ value.

$\Gamma(\eta\pi^-\pi^0\pi^0\nu_\tau)/\Gamma_{total}$ — Γ_{125}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.5±0.5		30	[233] ANASTASSOV	01	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.4±0.6±0.3		15	[234] BERGFELD	97	CLEO	Repl. by ANASTASSOV 01
< 4.3	95		ARTUSO	92	CLEO	$E^{ee}_{cm}\approx$ 10.6 GeV
<120	95		ALBRECHT	88M	ARG	$E^{ee}_{cm}\approx$ 10 GeV

[233] Weighted average of BERGFELD 97 and ANASTASSOV 01 value of $(1.5 \pm 0.6 \pm 0.3) \times 10^{-4}$ obtained using η's reconstructed from $\eta \to \pi^+\pi^-\pi^0$ decays.
[234] BERGFELD 97 reconstruct η's using $\eta \to \gamma\gamma$ decays.

$\Gamma(\eta K^-\nu_\tau)/\Gamma_{total}$ — Γ_{126}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.7±0.6 OUR FIT						
2.7±0.6 OUR AVERAGE						
$2.9^{+1.3}_{-1.2}\pm0.7$			BUSKULIC	97C	ALEP	1991–1994 LEP runs
2.6±0.5±0.5		85	BARTELT	96	CLEO	$E^{ee}_{cm}\approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4.7	95		ARTUSO	92	CLEO	$E^{ee}_{cm}\approx$ 10.6 GeV

$\Gamma(\eta K^*(892)^-\nu_\tau)/\Gamma_{total}$ — Γ_{127}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.90±0.80±0.42	25	BISHAI	99	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\eta K^-\pi^0\nu_\tau)/\Gamma_{total}$ — Γ_{128}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.77±0.56±0.71	36	BISHAI	99	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\eta\overline{K}^0\pi^-\nu_\tau)/\Gamma_{total}$ — Γ_{129}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.20±0.70±0.22	15	[235] BISHAI	99	CLEO	E^{ee}_{cm}= 10.6 GeV

[235] We multiply the BISHAI 99 measurement $B(\tau^- \to \eta K^0_S\pi^-\nu_\tau) = (1.10 \pm 0.35 \pm 0.11) \times 10^{-4}$ by 2 to obtain the listed value.

$\Gamma(\eta\pi^+\pi^-\pi^- \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{total}$ — Γ_{130}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.3	90	ABACHI	87B	HRS	E^{ee}_{cm}= 29 GeV

$\Gamma(\eta\pi^-\pi^+\pi^-\nu_\tau)/\Gamma_{total}$ — Γ_{131}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.3±0.5	170	[236] ANASTASSOV	01	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.4^{+0.6}_{-0.5}\pm0.6$	89	[237] BERGFELD	97	CLEO	Repl. by ANASTASSOV 01

[236] Weighted average of BERGFELD 97 and ANASTASSOV 01 measurements using η's reconstructed from $\eta \rightarrow \pi^+ \pi^- \pi^0$ and $\eta \rightarrow 3\pi^0$ decays.
[237] BERGFELD 97 reconstruct η's using $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi^0$ decays.

$\Gamma(\eta a_1(1260)^- \nu_\tau \rightarrow \eta \pi^- \rho^0 \nu_\tau)/\Gamma_{total}$ — Γ_{132}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.9 × 10^{-4}	90	BERGFELD	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\eta\eta\pi^- \nu_\tau)/\Gamma_{total}$ — Γ_{133}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.1	95	ARTUSO	92	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<83	95	ALBRECHT	88M	ARG	$E^{ee}_{cm} \approx$ 10 GeV

$\Gamma(\eta\eta\pi^- \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{134}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 2.0	95	ARTUSO	92	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<90	95	ALBRECHT	88M	ARG	$E^{ee}_{cm} \approx$ 10 GeV

$\Gamma(\eta'(958)\pi^- \nu_\tau)/\Gamma_{total}$ — Γ_{135}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.4 × 10^{-5}	90	BERGFELD	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\eta'(958)\pi^- \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{136}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<8.0 × 10^{-5}	90	BERGFELD	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\phi\pi^- \nu_\tau)/\Gamma_{total}$ — Γ_{137}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.0 × 10^{-4}	90	[238] AVERY	97	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.5 × 10^{-4}	90	ALBRECHT	95H	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[238] AVERY 97 limit varies from (1.2–2.0) × 10^{-4} depending on decay model assumptions.

$\Gamma(\phi K^- \nu_\tau)/\Gamma_{total}$ — Γ_{138}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.7 × 10^{-5}	90	[239] AVERY	97	CLEO	E^{ee}_{cm}= 10.6 GeV

[239] AVERY 97 limit varies from (5.4–6.7) × 10^{-5} depending on decay model assumptions.

$\Gamma(f_1(1285)\pi^- \nu_\tau)/\Gamma_{total}$ — Γ_{139}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
4.1±0.8 OUR AVERAGE					
3.9±0.7±0.5	1.4k	[240] AUBERT,B	05W	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
$5.8^{+1.4}_{-1.3}$±1.8	54	[241] BERGFELD	97	CLEO	E^{ee}_{cm}= 10.6 GeV

[240] AUBERT,B 05W use the $f_1(1285) \rightarrow 2\pi^+ 2\pi^-$ decay mode.
[241] BERGFELD 97 use the $f_1(1285) \rightarrow \eta\pi^+ \pi^-$ decay mode.

$\Gamma(f_1(1285)\pi^-\nu_\tau \to \eta\pi^-\pi^+\pi^-\nu_\tau)/\Gamma(\eta\pi^-\pi^+\pi^-\nu_\tau)$ — $\Gamma_{140}/\Gamma_{131}$

VALUE	DOCUMENT ID		TECN	COMMENT
0.55±0.14	BERGFELD	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\pi(1300)^-\nu_\tau \to (\rho\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau)/\Gamma_{total}$ — Γ_{141}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.0 \times 10^{-4}$	90	ASNER	00	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\pi(1300)^-\nu_\tau \to ((\pi\pi)_{S-wave}\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau)/\Gamma_{total}$ — Γ_{142}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.9 \times 10^{-4}$	90	ASNER	00	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(h^-\omega \geq 0 \text{ neutrals } \nu_\tau)/\Gamma_{total}$ — Γ_{143}/Γ

$\Gamma_{143}/\Gamma = (\Gamma_{144}+\Gamma_{146})/\Gamma$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
2.39±0.09 OUR FIT Error includes scale factor of 1.2.						
1.65±0.3 ±0.2	**avg**	1513	ALBRECHT	88M	ARG	E^{ee}_{cm} ≈ 10 GeV

$\Gamma(h^-\omega\nu_\tau)/\Gamma_{total}$ — Γ_{144}/Γ

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE (%)		EVTS	DOCUMENT ID		TECN	COMMENT
1.99±0.08 OUR FIT Error includes scale factor of 1.2.						
1.92±0.07 OUR AVERAGE						
1.91±0.07±0.06	f&a	5803	BUSKULIC	97C	ALEP	1991–1994 LEP runs
1.95±0.07±0.11	avg	2223	[242] BALEST	95C	CLEO	E^{ee}_{cm} ≈ 10.6 GeV
1.60±0.27±0.41	f&a	139	BARINGER	87	CLEO	E^{ee}_{cm}= 10.5 GeV

[242] Not independent of BALEST 95C $B(\tau^- \to h^-\omega\nu_\tau)/B(\tau^- \to h^-h^-h^+\pi^0\nu_\tau)$ value.

$\Gamma(h^-\omega\nu_\tau)/\Gamma(h^-h^-h^+\pi^0\nu_\tau(\text{ex.}K^0))$ — Γ_{144}/Γ_{66}

$\Gamma_{144}/\Gamma_{66} = \Gamma_{144}/(\Gamma_{70}+\Gamma_{89}+\Gamma_{94}+0.226\Gamma_{126}+0.888\Gamma_{144}+0.017\Gamma_{146})$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.437±0.017 OUR FIT Error includes scale factor of 1.2.					
0.453±0.019 OUR AVERAGE					
0.431±0.033	2350	[243] BUSKULIC	96	ALEP	LEP 1991–1993 data
0.464±0.016±0.017	2223	[244] BALEST	95C	CLEO	E^{ee}_{cm} ≈ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.37 ±0.05 ±0.02	458	[245] ALBRECHT	91D	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[243] BUSKULIC 96 quote the fraction of $\tau \rightarrow h^- h^- h^+ \pi^0 \nu_\tau$ (ex. K^0) decays which originate in a $h^- \omega$ final state = 0.383 ± 0.029. We divide this by the $\omega(782) \rightarrow \pi^+ \pi^- \pi^0$ branching fraction (0.888).

[244] BALEST 95C quote the fraction of $\tau^- \rightarrow h^- h^- h^+ \pi^0 \nu_\tau$ (ex. K^0) decays which originate in a $h^- \omega$ final state equals 0.412 ± 0.014 ± 0.015. We divide this by the $\omega(782) \rightarrow \pi^+ \pi^- \pi^0$ branching fraction (0.888).

[245] ALBRECHT 91D quote the fraction of $\tau^- \rightarrow h^- h^- h^+ \pi^0 \nu_\tau$ decays which originate in a $\pi^- \omega$ final state equals $0.33 \pm 0.04 \pm 0.02$. We divide this by the $\omega(782) \rightarrow \pi^+ \pi^- \pi^0$ branching fraction (0.888).

$\Gamma(K^- \omega \nu_\tau)/\Gamma_{total}$ — Γ_{145}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
4.1±0.6±0.7	500	ARMS	05	CLE3	7.6 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(h^- \omega \pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{146}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.41±0.04 OUR FIT					
0.43±0.06±0.05	7283	BUSKULIC	97C	ALEP	1991–1994 LEP runs

$\Gamma(h^- \omega 2\pi^0 \nu_\tau)/\Gamma_{total}$ — Γ_{147}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.4 ±0.4 ±0.3	53	ANASTASSOV	01	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.89^{+0.74}_{-0.67}\pm0.40$	19	ANDERSON	97	CLEO	Repl. by ANASTASSOV 01

$\Gamma(h^- \omega \pi^0 \nu_\tau)/\Gamma(h^- h^- h^+ \geq 0\,\text{neutrals} \geq 0K^0_L \nu_\tau)$ — Γ_{146}/Γ_{54}

$\Gamma_{146}/\Gamma_{54} = \Gamma_{146}/(0.3431\Gamma_{35}+0.3431\Gamma_{37}+0.3431\Gamma_{40}+0.3431\Gamma_{42}+0.4307\Gamma_{47}+0.6861\Gamma_{48}+\Gamma_{62}+\Gamma_{70}+\Gamma_{77}+\Gamma_{78}+\Gamma_{85}+\Gamma_{89}+\Gamma_{93}+\Gamma_{94}+0.285\Gamma_{124}+0.285\Gamma_{126}+0.9101\Gamma_{144}+0.9101\Gamma_{146})$

Data marked "avg" are highly correlated with data appearing elsewhere in the Listings, and are therefore used for the average given below but not in the overall fits. "f&a" marks results used for the fit and the average.

VALUE		EVTS	DOCUMENT ID		TECN	COMMENT
0.0267±0.0028 OUR FIT						
0.028 ±0.003 ±0.003	**avg**	430	[246] BORTOLETTO	93	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV

[246] Not independent of BORTOLETTO 93 $\Gamma(\tau^- \rightarrow h^- \omega \pi^0 \nu_\tau)/\Gamma(\tau^- \rightarrow h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0))$ value.

$\Gamma(h^- \omega \pi^0 \nu_\tau)/\Gamma(h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0))$ — Γ_{146}/Γ_{76}

$\Gamma_{146}/\Gamma_{76} = \Gamma_{146}/(\Gamma_{77}+0.226\Gamma_{124}+0.888\Gamma_{146})$

VALUE	DOCUMENT ID		TECN	COMMENT
0.83±0.08 OUR FIT				
0.81±0.06±0.06	BORTOLETTO	93	CLEO	$E^{ee}_{cm} \approx$ 10.6 GeV

$\Gamma(2h^- h^+ \omega \nu_\tau)/\Gamma_{total}$ — Γ_{148}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.2±0.2 ±0.1	110	ANASTASSOV	01	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^-\gamma)/\Gamma_{total}$ — Γ_{149}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.1 \times 10^{-7}$	90	AUBERT	06C	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.9 \times 10^{-7}$	90	HAYASAKA	05	BELL	86.7 fb^{-1}, E^{ee}_{cm}=10.6 GeV
$<2.7 \times 10^{-6}$	90	EDWARDS	97	CLEO	
$<1.1 \times 10^{-4}$	90	ABREU	95U	DLPH	1990–1993 LEP runs
$<1.2 \times 10^{-4}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<2.0 \times 10^{-4}$	90	KEH	88	CBAL	E^{ee}_{cm}= 10 GeV
$<6.4 \times 10^{-4}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(\mu^-\gamma)/\Gamma_{total}$ — Γ_{150}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 6.8 \times 10^{-8}$	90	AUBERT,B	05A	BABR	232 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 3.1 \times 10^{-7}$	90	ABE	04B	BELL	86.3 fb^{-1}, E^{ee}_{cm} = 10.6 GeV
$< 1.1 \times 10^{-6}$	90	AHMED	00	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 3.0 \times 10^{-6}$	90	EDWARDS	97	CLEO	
$< 6.2 \times 10^{-5}$	90	ABREU	95U	DLPH	1990–1993 LEP runs
$< 0.42 \times 10^{-5}$	90	BEAN	93	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 3.4 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<55 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(e^-\pi^0)/\Gamma_{total}$ — Γ_{151}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 1.9 \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 3.7 \times 10^{-6}$	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 17 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$< 14 \times 10^{-5}$	90	KEH	88	CBAL	E^{ee}_{cm}= 10 GeV
$<210 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(\mu^-\pi^0)/\Gamma_{total}$ — Γ_{152}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 4.1 \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 4.0 \times 10^{-6}$	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 4.4 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<82 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(e^- K^0_S)/\Gamma_{total}$ Γ_{153}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<9.1 \times 10^{-7}$	90	CHEN	02C	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.3 \times 10^{-3}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(\mu^- K^0_S)/\Gamma_{total}$ Γ_{154}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<9.5 \times 10^{-7}$	90	CHEN	02C	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.0 \times 10^{-3}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

$\Gamma(e^- \eta)/\Gamma_{total}$ Γ_{155}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.4 \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 8.2 \times 10^{-6}$	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 6.3 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<24 \times 10^{-5}$	90	KEH	88	CBAL	E^{ee}_{cm}= 10 GeV

$\Gamma(\mu^- \eta)/\Gamma_{total}$ Γ_{156}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.5 \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.4 \times 10^{-7}$	90	ENARI	04	BELL	84.3 fb^{-1}, E^{ee}_{cm}=10.6 GeV
$<9.6 \times 10^{-6}$	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV
$<7.3 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

$\Gamma(e^- \rho^0)/\Gamma_{total}$ Γ_{157}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.0 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 0.42 \times 10^{-5}$	90	[247] BARTELT	94	CLEO	Repl. by BLISS 98
$< 1.9 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<37 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

[247] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- \rho^0)/\Gamma_{total}$ Γ_{158}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 6.3 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 0.57 \times 10^{-5}$	90	[248] BARTELT	94	CLEO	Repl. by BLISS 98
$< 2.9 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<44 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

[248] BARTELT 94 assume phase space decays.

$\Gamma(e^- K^*(892)^0)/\Gamma_{total}$ Γ_{159}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.1 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<0.63 \times 10^{-5}$	90	[249] BARTELT	94	CLEO	Repl. by BLISS 98
$<3.8 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

[249] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- K^*(892)^0)/\Gamma_{total}$ Γ_{160}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.5 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<0.94 \times 10^{-5}$	90	[250] BARTELT	94	CLEO	Repl. by BLISS 98
$<4.5 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

[250] BARTELT 94 assume phase space decays.

$\Gamma(e^- \overline{K}^*(892)^0)/\Gamma_{total}$ Γ_{161}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.4 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.1 \times 10^{-5}$	90	[251] BARTELT	94	CLEO	Repl. by BLISS 98

[251] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- \overline{K}^*(892)^0)/\Gamma_{total}$ Γ_{162}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.5 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<0.87 \times 10^{-5}$	90	[252] BARTELT	94	CLEO	Repl. by BLISS 98

[252] BARTELT 94 assume phase space decays.

$\Gamma(e^- \eta'(958))/\Gamma_{total}$ Γ_{163}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<10. \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \eta'(958))/\Gamma_{total}$ — Γ_{164}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4.7 \times 10^{-7}$	90	ENARI	05	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- \phi)/\Gamma_{total}$ — Γ_{165}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.9 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \phi)/\Gamma_{total}$ — Γ_{166}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.0 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- e^+ e^-)/\Gamma_{total}$ — Γ_{167}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.0 \times 10^{-7}$	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 3.5 \times 10^{-7}$	90	YUSA	04	BELL	87.1 fb^{-1} at E^{ee}_{cm}= 10.6 GeV
$< 2.9 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 0.33 \times 10^{-5}$	90	[253] BARTELT	94	CLEO	Repl. by BLISS 98
$< 1.3 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$< 2.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9
$<40 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

[253] BARTELT 94 assume phase space decays.

$\Gamma(e^- \mu^+ \mu^-)/\Gamma_{total}$ — Γ_{168}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.0 \times 10^{-7}$	90	YUSA	04	BELL	87.1 fb^{-1} at E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 3.3 \times 10^{-7}$	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV
$< 1.8 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 0.36 \times 10^{-5}$	90	[254] BARTELT	94	CLEO	Repl. by BLISS 98
$< 1.9 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$< 2.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9
$<33 \times 10^{-5}$	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

[254] BARTELT 94 assume phase space decays.

$\Gamma(e^+\mu^-\mu^-)/\Gamma_{total}$ — Γ_{169}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.3 × 10^−7	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.0 × 10^−7	90	YUSA	04	BELL	87.1 fb^{-1} at E^{ee}_{cm}= 10.6 GeV
<1.5 × 10^−6	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.35 × 10^−5	90	[255] BARTELT	94	CLEO	Repl. by BLISS 98
<1.8 × 10^−5	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
<1.6 × 10^−5	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[255] BARTELT 94 assume phase space decays.

$\Gamma(\mu^-e^+e^-)/\Gamma_{total}$ — Γ_{170}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 1.9 × 10^−7	90	YUSA	04	BELL	87.1 fb^{-1} at E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 2.7 × 10^−7	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV
< 1.7 × 10^−6	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
< 0.34 × 10^−5	90	[256] BARTELT	94	CLEO	Repl. by BLISS 98
< 1.4 × 10^−5	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
< 2.7 × 10^−5	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9
<44 × 10^−5	90	HAYES	82	MRK2	E^{ee}_{cm}= 3.8–6.8 GeV

[256] BARTELT 94 assume phase space decays.

$\Gamma(\mu^+e^-e^-)/\Gamma_{total}$ — Γ_{171}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.1 × 10^−7	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.0 × 10^−7	90	YUSA	04	BELL	87.1 fb^{-1} at E^{ee}_{cm}= 10.6 GeV
<1.5 × 10^−6	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.34 × 10^−5	90	[257] BARTELT	94	CLEO	Repl. by BLISS 98
<1.4 × 10^−5	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
<1.6 × 10^−5	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[257] BARTELT 94 assume phase space decays.

$\Gamma(\mu^-\mu^+\mu^-)/\Gamma_{total}$ — Γ_{172}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 1.9 × 10^−7	90	AUBERT	04J	BABR	91.5 fb^{-1} E^{ee}_{cm}= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 2.0 \times 10^{-7}$	90	YUSA	04	BELL	87.1 fb^{-1} at $E^{ee}_{\rm cm}$= 10.6 GeV
$< 1.9 \times 10^{-6}$	90	BLISS	98	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV
$< 0.43 \times 10^{-5}$	90	[258] BARTELT	94	CLEO	Repl. by BLISS 98
$< 1.9 \times 10^{-5}$	90	ALBRECHT	92K	ARG	$E^{ee}_{\rm cm}$= 10 GeV
$< 1.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	$E^{ee}_{\rm cm}$= 10.4–10.9
$<49 \times 10^{-5}$	90	HAYES	82	MRK2	$E^{ee}_{\rm cm}$= 3.8–6.8 GeV

[258] BARTELT 94 assume phase space decays.

$\Gamma(e^- \pi^+ \pi^-)/\Gamma_{\rm total}$ Γ_{173}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.2 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, $E^{ee}_{\rm cm}$= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<2.2 \times 10^{-6}$	90	BLISS	98	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV
$<0.44 \times 10^{-5}$	90	[259] BARTELT	94	CLEO	Repl. by BLISS 98
$<2.7 \times 10^{-5}$	90	ALBRECHT	92K	ARG	$E^{ee}_{\rm cm}$= 10 GeV
$<6.0 \times 10^{-5}$	90	BOWCOCK	90	CLEO	$E^{ee}_{\rm cm}$= 10.4–10.9

[259] BARTELT 94 assume phase space decays.

$\Gamma(e^+ \pi^- \pi^-)/\Gamma_{\rm total}$ Γ_{174}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.7 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, $E^{ee}_{\rm cm}$= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1.9 \times 10^{-6}$	90	BLISS	98	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV
$<0.44 \times 10^{-5}$	90	[260] BARTELT	94	CLEO	Repl. by BLISS 98
$<1.8 \times 10^{-5}$	90	ALBRECHT	92K	ARG	$E^{ee}_{\rm cm}$= 10 GeV
$<1.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	$E^{ee}_{\rm cm}$= 10.4–10.9

[260] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- \pi^+ \pi^-)/\Gamma_{\rm total}$ Γ_{175}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.9 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, $E^{ee}_{\rm cm}$= 10.6 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<8.2 \times 10^{-6}$	90	BLISS	98	CLEO	$E^{ee}_{\rm cm}$= 10.6 GeV
$<0.74 \times 10^{-5}$	90	[261] BARTELT	94	CLEO	Repl. by BLISS 98
$<3.6 \times 10^{-5}$	90	ALBRECHT	92K	ARG	$E^{ee}_{\rm cm}$= 10 GeV
$<3.9 \times 10^{-5}$	90	BOWCOCK	90	CLEO	$E^{ee}_{\rm cm}$= 10.4–10.9

[261] BARTELT 94 assume phase space decays.

$\Gamma(\mu^+\pi^-\pi^-)/\Gamma_{total}$ — Γ_{176}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.7 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.4 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.69 × 10^{-5}	90	[262] BARTELT	94	CLEO	Repl. by BLISS 98
<6.3 × 10^{-5}	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
<3.9 × 10^{-5}	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[262] BARTELT 94 assume phase space decays.

$\Gamma(e^-\pi^+K^-)/\Gamma_{total}$ — Γ_{177}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.2 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.4 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.77 × 10^{-5}	90	[263] BARTELT	94	CLEO	Repl. by BLISS 98
<2.9 × 10^{-5}	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
<5.8 × 10^{-5}	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[263] BARTELT 94 assume phase space decays.

$\Gamma(e^-\pi^-K^+)/\Gamma_{total}$ — Γ_{178}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.7 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.8 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.46 × 10^{-5}	90	[264] BARTELT	94	CLEO	Repl. by BLISS 98
<5.8 × 10^{-5}	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[264] BARTELT 94 assume phase space decays.

$\Gamma(e^+\pi^-K^-)/\Gamma_{total}$ — Γ_{179}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.8 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.1 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
<0.45 × 10^{-5}	90	[265] BARTELT	94	CLEO	Repl. by BLISS 98
<2.0 × 10^{-5}	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
<4.9 × 10^{-5}	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[265] BARTELT 94 assume phase space decays.

$\Gamma(e^-K^0_SK^0_S)/\Gamma_{total}$ — Γ_{180}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.2 × 10^{-6}	90	CHEN	02C	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- K^+ K^-)/\Gamma_{total}$ Γ_{181}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.4 \times 10^{-7}$	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.0 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^+ K^- K^-)/\Gamma_{total}$ Γ_{182}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.5 \times 10^{-7}$	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.8 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \pi^+ K^-)/\Gamma_{total}$ Γ_{183}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.6 \times 10^{-7}$	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 7.5 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
$< 0.87 \times 10^{-5}$	90	[266] BARTELT	94	CLEO	Repl. by BLISS 98
$<11 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$< 7.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[266] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- \pi^- K^+)/\Gamma_{total}$ Γ_{184}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.2 \times 10^{-7}$	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<7.4 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
$<1.5 \times 10^{-5}$	90	[267] BARTELT	94	CLEO	Repl. by BLISS 98
$<7.7 \times 10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[267] BARTELT 94 assume phase space decays.

$\Gamma(\mu^+ \pi^- K^-)/\Gamma_{total}$ Γ_{185}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.2 \times 10^{-7}$	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<7.0 \times 10^{-6}$	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV
$<2.0 \times 10^{-5}$	90	[268] BARTELT	94	CLEO	Repl. by BLISS 98
$<5.8 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV
$<4.0 \times 10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm}= 10.4–10.9

[268] BARTELT 94 assume phase space decays.

$\Gamma(\mu^- K^0_S K^0_S)/\Gamma_{\text{total}}$ — Γ_{186}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.4 × 10^{-6}	90	CHEN	02C	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- K^+ K^-)/\Gamma_{\text{total}}$ — Γ_{187}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 2.5 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<15 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^+ K^- K^-)/\Gamma_{\text{total}}$ — Γ_{188}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.8 × 10^{-7}	90	AUBERT,BE	05D	BABR	221 fb^{-1}, E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.0 × 10^{-6}	90	BLISS	98	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ — Γ_{189}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.5 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ — Γ_{190}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<14 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- \eta\eta)/\Gamma_{\text{total}}$ — Γ_{191}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<35 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \eta\eta)/\Gamma_{\text{total}}$ — Γ_{192}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<60 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^- \pi^0 \eta)/\Gamma_{\text{total}}$ — Γ_{193}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<24 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\mu^- \pi^0 \eta)/\Gamma_{\text{total}}$ — Γ_{194}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<22 × 10^{-6}	90	BONVICINI	97	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\overline{p}\gamma)/\Gamma_{\text{total}}$ — Γ_{195}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 3.5 \times 10^{-6}$	90	GODANG	99	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<29 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

$\Gamma(\overline{p}\pi^0)/\Gamma_{\text{total}}$ — Γ_{196}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<15 \times 10^{-6}$	90	GODANG	99	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<66 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

$\Gamma(\overline{p}2\pi^0)/\Gamma_{\text{total}}$ — Γ_{197}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<33 \times 10^{-6}$	90	GODANG	99	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\overline{p}\eta)/\Gamma_{\text{total}}$ — Γ_{198}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 8.9 \times 10^{-6}$	90	GODANG	99	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<130 \times 10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm}= 10 GeV

$\Gamma(\overline{p}\pi^0\eta)/\Gamma_{\text{total}}$ — Γ_{199}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<27 \times 10^{-6}$	90	GODANG	99	CLEO	E^{ee}_{cm}= 10.6 GeV

$\Gamma(\Lambda\pi^-)/\Gamma_{\text{total}}$ — Γ_{200}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<0.72 \times 10^{-7}$	90	MIYAZAKI	06	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(\overline{\Lambda}\pi^-)/\Gamma_{\text{total}}$ — Γ_{201}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.4 \times 10^{-7}$	90	MIYAZAKI	06	BELL	154 fb^{-1}, E^{ee}_{cm}= 10.6 GeV

$\Gamma(e^-\text{ light boson})/\Gamma(e^-\overline{\nu}_e\nu_\tau)$ — Γ_{202}/Γ_5

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.015	95	[269] ALBRECHT	95G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.018	95	[270] ALBRECHT	90E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
<0.040	95	[271] BALTRUSAIT...	85	MRK3	E^{ee}_{cm}= 3.77 GeV

[269] ALBRECHT 95G limit holds for bosons with mass < 0.4 GeV. The limit rises to 0.036 for a mass of 1.0 GeV, then falls to 0.006 at the upper mass limit of 1.6 GeV.
[270] ALBRECHT 90E limit applies for spinless boson with mass < 100 MeV, and rises to 0.050 for mass = 500 MeV.
[271] BALTRUSAITIS 85 limit applies for spinless boson with mass < 100 MeV.

$\Gamma(\mu^-$ light boson$)/\Gamma(e^-\overline{\nu}_e\nu_\tau)$ — Γ_{203}/Γ_5

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.026	95	[272] ALBRECHT	95G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.033	95	[273] ALBRECHT	90E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
<0.125	95	[274] BALTRUSAIT...	85	MRK3	E^{ee}_{cm}= 3.77 GeV

[272] ALBRECHT 95G limit holds for bosons with mass < 1.3 GeV. The limit rises to 0.034 for a mass of 1.4 GeV, then falls to 0.003 at the upper mass limit of 1.6 GeV.
[273] ALBRECHT 90E limit applies for spinless boson with mass < 100 MeV, and rises to 0.071 for mass = 500 MeV.
[274] BALTRUSAITIS 85 limit applies for spinless boson with mass < 100 MeV.

τ-DECAY PARAMETERS

τ-LEPTON DECAY PARAMETERS

Written April 2002 by A. Stahl (RWTH Aachen).

The purpose of the measurements of the decay parameters (*i.e.,* Michel parameters) of the τ is to determine the structure (spin and chirality) of the current mediating its decays.

Leptonic Decays: The Michel parameters are extracted from the energy spectrum of the charged daughter lepton $\ell = e, \mu$ in the decays $\tau \to \ell\nu_\ell\nu_\tau$. Ignoring radiative corrections, neglecting terms of order $(m_\ell/m_\tau)^2$ and $(m_\tau/\sqrt{s})^2$, and setting the neutrino masses to zero, the spectrum in the laboratory frame reads

$$\frac{d\Gamma}{dx} = \frac{G^2_{\tau\ell}\ m^5_\tau}{192\ \pi^3}\ \times$$
$$\left\{f_0(x) + \rho f_1(x) + \eta\frac{m_\ell}{m_\tau}f_2(x) - P_\tau\left[\xi g_1(x) + \xi\delta g_2(x)\right]\right\}\ , \quad (1)$$

with

$$
\begin{aligned}
& f_0(x) = 2 - 6x^2 + 4x^3 && \\
& f_1(x) = -\frac{4}{9} + 4x^2 - \frac{32}{9}x^3 && g_1(x) = -\frac{2}{3} + 4x - 6x^2 + \frac{8}{3}x^3 \\
& f_2(x) = 12(1-x)^2 && g_2(x) = \frac{4}{9} - \frac{16}{3}x + 12x^2 - \frac{64}{9}x^3 \ .
\end{aligned}
$$

The integrated decay width is given by

$$
\Gamma = \frac{G_{\tau\ell}^2 \ m_\tau^5}{192 \ \pi^3} \left(1 + 4\,\eta \ \frac{m_\ell}{m_\tau} \right) \ . \tag{2}
$$

The situation is similar to muon decays $\mu \to e\nu_e\nu_\mu$. The generalized matrix element with the couplings $g_{\varepsilon\mu}^{\gamma}$ and their relations to the Michel parameters ρ, η, ξ, and δ have been described in the "Note on Muon Decay Parameters". The Standard Model expectations are 3/4, 0, 1, and 3/4, respectively. For more details, see Ref. 1.

Hadronic Decays: In the case of hadronic decays $\tau \to h\nu_\tau$, with $h = \pi$, ρ, or a_1, the ansatz is restricted to purely vectorial currents. The matrix element is

$$
\frac{G_{\tau h}}{\sqrt{2}} \sum_{\lambda=R,L} g_\lambda \ \langle \ \overline{\Psi}_\omega(\nu_\tau) \ | \ \gamma^\mu \ | \ \Psi_\lambda(\tau) \ \rangle \quad J_\mu^h \tag{3}
$$

with the hadronic current J_μ^h. The neutrino chirality ω is uniquely determined from λ. The spectrum depends only on a single parameter ξ_h

$$
\frac{d\Gamma}{d\vec{x}} = f(\vec{x}) + \xi_h P_\tau g(\vec{x}) \ , \tag{4}
$$

with f and g being channel-dependent functions of the observables $\vec{x}$ (see Ref. 2). The parameter ξ_h is related to the couplings through

$$
\xi_h = |g_L|^2 - |g_R|^2 \ . \tag{5}
$$

ξ_h is the negative of the chirality of the τ neutrino in these decays. In the Standard Model, $\xi_h = 1$. Also included are measurements of the neutrino helicity which coincide with ξ_h, if the neutrino is massless (ASNER 00, ACKERSTAFF 97R, AKERS 95P, ALBRECHT 93C, and ALBRECHT 90I).

Combination of Measurements: The individual measurements are combined, taking into account the correlations between the parameters. There is one fit, assuming universality between the two leptonic decays, and between all hadronic decays and a second fit without these assumptions. These are the values labeled 'OUR FIT' in the tables. The measurements show good agreement with the Standard Model. The χ^2 values with respect to the Standard model predictions are 24.1 for 41 degrees of freedom and 26.8 for 56 degrees of freedom, respectively. The correlations are reduced through this combination to less than 20%, with the exception of ρ and η which are correlated by +23%, for the fit with universality and by +70% for $\tau \to \mu\nu_\mu\nu_\tau$.

Model-independent Analysis: From the Michel parameters, limits can be derived on the couplings $g^\kappa_{\varepsilon\lambda}$ without further module assumptions. In the Standard model $g^V_{LL} = 1$ (leptonic decays), and $g_L = 1$ (hadronic decays) and all other couplings vanish. First, the partial decay widths have to be compared to the Standard Model predictions to derive limits on the normalization of the couplings $A_x = G^2_{\tau x}/G^2_F$ with Fermi's constant G_F:

$$A_e = 1.0012 \pm 0.0053 \; ,$$

$$A_\mu = 0.981 \pm 0.018 \; ,$$

$$A_\pi = 1.018 \pm 0.012 \; . \qquad (6)$$

Then limits on the couplings (95% CL) can be extracted (see Ref. 3 and Ref. 4). Without the assumption of universality, the limits given in Table 1 are derived.

Table 1: Coupling constants $g^{\gamma}_{\varepsilon\mu}$. 95% confidence level experimental limits. The limits include the quoted values of A_e, A_μ, and A_π and assume $A_\rho = A_{a_1} = 1$.

$\tau \to e\nu_e\nu_\tau$		
$\lvert g^S_{RR}\rvert < 0.70$	$\lvert g^V_{RR}\rvert < 0.17$	$\lvert g^T_{RR}\rvert \equiv 0$
$\lvert g^S_{LR}\rvert < 0.99$	$\lvert g^V_{LR}\rvert < 0.13$	$\lvert g^T_{LR}\rvert < 0.082$
$\lvert g^S_{RL}\rvert < 2.01$	$\lvert g^V_{RL}\rvert < 0.52$	$\lvert g^T_{RL}\rvert < 0.51$
$\lvert g^S_{LL}\rvert < 2.01$	$\lvert g^V_{LL}\rvert < 1.005$	$\lvert g^T_{LL}\rvert \equiv 0$
$\tau \to \mu\nu_\mu\nu_\tau$		
$\lvert g^S_{RR}\rvert < 0.72$	$\lvert g^V_{RR}\rvert < 0.18$	$\lvert g^T_{RR}\rvert \equiv 0$
$\lvert g^S_{LR}\rvert < 0.95$	$\lvert g^V_{LR}\rvert < 0.12$	$\lvert g^T_{LR}\rvert < 0.079$
$\lvert g^S_{RL}\rvert < 2.01$	$\lvert g^V_{RL}\rvert < 0.52$	$\lvert g^T_{RL}\rvert < 0.51$
$\lvert g^S_{LL}\rvert < 2.01$	$\lvert g^V_{LL}\rvert < 1.005$	$\lvert g^T_{LL}\rvert \equiv 0$
$\tau \to \pi\nu_\tau$		
$\lvert g^V_R\rvert < 0.15$	$\lvert g^V_L\rvert > 0.992$	
$\tau \to \rho\nu_\tau$		
$\lvert g^V_R\rvert < 0.10$	$\lvert g^V_L\rvert > 0.995$	
$\tau \to a_1\nu_\tau$		
$\lvert g^V_R\rvert < 0.16$	$\lvert g^V_L\rvert > 0.987$	

Model-dependent Interpretation: More stringent limits can be derived assuming specific models. For example, in the framework of a two Higgs doublet model, the measurements correspond to a limit of $m_{H^\pm} > 1.9\ \mathrm{GeV} \times \tan\beta$ on the mass of the charged Higgs boson, or a limit of 253 GeV on the mass of the second W boson in left-right symmetric models for arbitrary mixing (both 95% CL). See Ref. 4 and Ref. 5.

Footnotes and References

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$\rho^\tau(e \text{ or } \mu)$ PARAMETER

$(V-A)$ theory predicts $\rho = 0.75$.

VALUE	EVTS		DOCUMENT ID		TECN	COMMENT
0.745±0.008 OUR FIT						
0.749±0.008 OUR AVERAGE						
0.742±0.014±0.006	81k		HEISTER	01E	ALEP	1991–1995 LEP runs
0.775±0.023±0.020	36k		ABREU	00L	DLPH	1992–1995 runs
0.781±0.028±0.018	46k		ACKERSTAFF	99D	OPAL	1990–1995 LEP runs
0.762±0.035	54k		ACCIARRI	98R	L3	1991–1995 LEP runs
0.731±0.031		275	ALBRECHT	98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.72 ±0.09 ±0.03		276	ABE	97O	SLD	1993–1995 SLC runs
0.747±0.010±0.006	55k		ALEXANDER	97F	CLEO	E^{ee}_{cm}= 10.6 GeV
0.79 ±0.10 ±0.10	3732		FORD	87B	MAC	E^{ee}_{cm}= 29 GeV
0.71 ±0.09 ±0.03	1426		BEHRENDS	85	CLEO	e^+e^- near $\Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.735±0.013±0.008	31k		AMMAR	97B CLEO	Repl. by ALEXANDER 97F
0.794±0.039±0.031	18k		ACCIARRI	96H L3	Repl. by ACCIARRI 98R
0.732±0.034±0.020	8.2k	277	ALBRECHT	95 ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.738±0.038		278	ALBRECHT	95C ARG	Repl. by ALBRECHT 98
0.751±0.039±0.022			BUSKULIC	95D ALEP	Repl. by HEISTER 01E
0.742±0.035±0.020	8000		ALBRECHT	90E ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[275] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 98, ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E. ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \to (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

[276] ABE 97O assume $\eta^\tau = 0$ in their fit. Letting η^τ vary in the fit gives a ρ^τ value of 0.69 ± 0.13 ± 0.05.

[277] Value is from a simultaneous fit for the ρ^τ and η^τ decay parameters to the lepton energy spectrum. Not independent of ALBRECHT 90E $\rho^\tau(e \text{ or } \mu)$ value which assumes η^τ=0. Result is strongly correlated with ALBRECHT 95C.

[278] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E.

$\rho^\tau(e)$ PARAMETER

($V-A$) theory predicts $\rho = 0.75$.

VALUE	EVTS		DOCUMENT ID	TECN	COMMENT
0.747±0.010 OUR FIT					
0.744±0.010 OUR AVERAGE					
0.747±0.019±0.014	44k		HEISTER	01E ALEP	1991–1995 LEP runs
0.744±0.036±0.037	17k		ABREU	00L DLPH	1992–1995 runs
0.779±0.047±0.029	25k		ACKERSTAFF	99D OPAL	1990–1995 LEP runs
0.68 ±0.04 ±0.07		279	ALBRECHT	98 ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.71 ±0.14 ±0.05			ABE	97O SLD	1993–1995 SLC runs
0.747±0.012±0.004	34k		ALEXANDER	97F CLEO	E^{ee}_{cm}= 10.6 GeV
0.735±0.036±0.020	4.7k	280	ALBRECHT	95 ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.79 ±0.08 ±0.06	3230	281	ALBRECHT	93G ARG	E^{ee}_{cm}= 9.4–10.6 GeV
0.64 ±0.06 ±0.07	2753		JANSSEN	89 CBAL	E^{ee}_{cm}= 9.4–10.6 GeV
0.62 ±0.17 ±0.14	1823		FORD	87B MAC	E^{ee}_{cm}= 29 GeV
0.60 ±0.13	699		BEHRENDS	85 CLEO	e^+e^- near $\Upsilon(4S)$
0.72 ±0.10 ±0.11	594		BACINO	79B DLCO	E^{ee}_{cm}= 3.5–7.4 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.732±0.014±0.009	19k		AMMAR	97B CLEO	Repl. by ALEXANDER 97F
0.793±0.050±0.025			BUSKULIC	95D ALEP	Repl. by HEISTER 01E
0.747±0.045±0.028	5106		ALBRECHT	90E ARG	Repl. by ALBRECHT 95

[279] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \to (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

[280] ALBRECHT 95 use tau pair events of the type $\tau^-\tau^+ \to (\ell^-\overline{\nu}_\ell\nu_\tau)(h^+h^-h^+(\pi^0)\overline{\nu}_\tau)$ and their charged conjugates.

[281] ALBRECHT 93G use tau pair events of the type $\tau^-\tau^+ \to (\mu^-\overline{\nu}_\mu\nu_\tau)(e^+\nu_e\overline{\nu}_\tau)$ and their charged conjugates.

$\rho^\tau(\mu)$ PARAMETER

($V-A$) theory predicts $\rho = 0.75$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.763±0.020 OUR FIT				
0.770±0.022 OUR AVERAGE				
0.776±0.045±0.019	46k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.999±0.098±0.045	22k	ABREU 00L	DLPH	1992–1995 runs
0.777±0.044±0.016	27k	ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
0.69 ±0.06 ±0.06		[282] ALBRECHT 98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.54 ±0.28 ±0.14		ABE 97O	SLD	1993–1995 SLC runs
0.750±0.017±0.045	22k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
0.76 ±0.07 ±0.08	3230	ALBRECHT 93G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
0.734±0.055±0.027	3041	ALBRECHT 90E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
0.89 ±0.14 ±0.08	1909	FORD 87B	MAC	E^{ee}_{cm}= 29 GeV
0.81 ±0.13	727	BEHRENDS 85	CLEO	e^+e^- near $\Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.747±0.048±0.044	13k	AMMAR 97B	CLEO	Repl. by ALEXANDER 97F
0.693±0.057±0.028		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[282] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

ξ^τ(*e* or μ) PARAMETER

($V-A$) theory predicts $\xi = 1$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.985±0.030 OUR FIT				
0.981±0.031 OUR AVERAGE				
0.986±0.068±0.031	81k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.929±0.070±0.030	36k	ABREU 00L	DLPH	1992–1995 runs
0.98 ±0.22 ±0.10	46k	ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
0.70 ±0.16	54k	ACCIARRI 98R	L3	1991–1995 LEP runs
1.03 ±0.11		[283] ALBRECHT 98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
1.05 ±0.35 ±0.04		[284] ABE 97O	SLD	1993–1995 SLC runs
1.007±0.040±0.015	55k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.94 ±0.21 ±0.07	18k	ACCIARRI 96H	L3	Repl. by ACCIARRI 98R
0.97 ±0.14		[285] ALBRECHT 95C	ARG	Repl. by ALBRECHT 98
1.18 ±0.15 ±0.16		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E
0.90 ±0.15 ±0.10	3230	[286] ALBRECHT 93G	ARG	E^{ee}_{cm}= 9.4–10.6 GeV

[283] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 98, ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E. ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

[284] ABE 97O assume $\eta^\tau = 0$ in their fit. Letting η^τ vary in the fit gives a ξ^τ value of $1.02 \pm 0.36 \pm 0.05$.

[285] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E. ALBRECHT 95C uses events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)\,(h^+h^-h^+\overline{\nu}_\tau)$ and their charged conjugates.

[286] ALBRECHT 93G measurement determines $\left|\xi^\tau\right|$ for the case $\xi^\tau(e) = \xi^\tau(\mu)$, but the authors point out that other LEP experiments determine the sign to be positive.

$\xi^\tau(e)$ PARAMETER

$(V-A)$ theory predicts $\xi = 1$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.994±0.040 OUR FIT					
1.00 ±0.04 OUR AVERAGE					
1.011±0.094±0.038	44k	HEISTER	01E	ALEP	1991–1995 LEP runs
1.01 ±0.12 ±0.05	17k	ABREU	00L	DLPH	1992–1995 runs
1.13 ±0.39 ±0.14	25k	ACKERSTAFF	99D	OPAL	1990–1995 LEP runs
1.11 ±0.20 ±0.08		[287] ALBRECHT	98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
1.16 ±0.52 ±0.06		ABE	97O	SLD	1993–1995 SLC runs
0.979±0.048±0.016	34k	ALEXANDER	97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.03 ±0.23 ±0.09		BUSKULIC	95D	ALEP	Repl. by HEISTER 01E

[287] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

$\xi^\tau(\mu)$ PARAMETER

$(V-A)$ theory predicts $\xi = 1$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.030±0.059 OUR FIT					
1.06 ±0.06 OUR AVERAGE					
1.030±0.120±0.050	46k	HEISTER	01E	ALEP	1991–1995 LEP runs
1.16 ±0.19 ±0.06	22k	ABREU	00L	DLPH	1992–1995 runs
0.79 ±0.41 ±0.09	27k	ACKERSTAFF	99D	OPAL	1990–1995 LEP runs
1.26 ±0.27 ±0.14		[288] ALBRECHT	98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.75 ±0.50 ±0.14		ABE	97O	SLD	1993–1995 SLC runs
1.054±0.069±0.047	22k	ALEXANDER	97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.23 ±0.22 ±0.10		BUSKULIC	95D	ALEP	Repl. by HEISTER 01E

[288] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

$\eta^\tau(e$ or $\mu)$ PARAMETER

$(V-A)$ theory predicts $\eta = 0$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.013±0.020 OUR FIT					
0.015±0.021 OUR AVERAGE					
0.012±0.026±0.004	81k	HEISTER	01E	ALEP	1991–1995 LEP runs
−0.005±0.036±0.037		ABREU	00L	DLPH	1992–1995 runs
0.027±0.055±0.005	46k	ACKERSTAFF	99D	OPAL	1990–1995 LEP runs
0.27 ±0.14	54k	ACCIARRI	98R	L3	1991–1995 LEP runs
−0.13 ±0.47 ±0.15		ABE	97O	SLD	1993–1995 SLC runs
−0.015±0.061±0.062	31k	AMMAR	97B	CLEO	E^{ee}_{cm}= 10.6 GeV
0.03 ±0.18 ±0.12	8.2k	ALBRECHT	95	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.25 ±0.17 ±0.11	18k	ACCIARRI	96H	L3	Repl. by ACCIARRI 98R
−0.04 ±0.15 ±0.11		BUSKULIC	95D	ALEP	Repl. by HEISTER 01E

$\eta^{\tau}(\mu)$ PARAMETER

$(V-A)$ theory predicts $\eta = 0$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.094±0.073 OUR FIT				
0.17 ±0.15 OUR AVERAGE Error includes scale factor of 1.2.				
0.160±0.150±0.060	46k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.72 ±0.32 ±0.15		ABREU 00L	DLPH	1992–1995 runs
−0.59 ±0.82 ±0.45		[289] ABE 97O	SLD	1993–1995 SLC runs
0.010±0.149±0.171	13k	[290] AMMAR 97B	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.010±0.065±0.001	27k	[291] ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
−0.24 ±0.23 ±0.18		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[289] Highly correlated (corr. = 0.92) with ABE 97O $\rho^{\tau}(\mu)$ measurement.

[290] Highly correlated (corr. = 0.949) with AMMAR 97B $\rho^{\tau}(\mu)$ value.

[291] ACKERSTAFF 99D result is dominated by a constraint on η^{τ} from the OPAL measurements of the τ lifetime and B($\tau^- \rightarrow \mu^- \overline{\nu}_{\mu} \nu_{\tau}$) assuming lepton universality for the total coupling strength.

$(\delta\xi)^{\tau}$(e or μ) PARAMETER

$(V-A)$ theory predicts $(\delta\xi) = 0.75$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.746±0.021 OUR FIT				
0.744±0.022 OUR AVERAGE				
0.776±0.045±0.024	81k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.779±0.070±0.028	36k	ABREU 00L	DLPH	1992–1995 runs
0.65 ±0.14 ±0.07	46k	ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
0.70 ±0.11	54k	ACCIARRI 98R	L3	1991–1995 LEP runs
0.63 ±0.09		[292] ALBRECHT 98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.88 ±0.27 ±0.04		[293] ABE 97O	SLD	1993–1995 SLC runs
0.745±0.026±0.009	55k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.81 ±0.14 ±0.06	18k	ACCIARRI 96H	L3	Repl. by ACCIARRI 98R
0.65 ±0.12		[294] ALBRECHT 95C	ARG	Repl. by ALBRECHT 98
0.88 ±0.11 ±0.07		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[292] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 98, ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E. ALBRECHT 98 use tau pair events of the type $\tau^- \tau^+ \rightarrow (\ell^- \overline{\nu}_{\ell} \nu_{\tau})(\pi^+ \pi^0 \overline{\nu}_{\tau})$, and their charged conjugates.

[293] ABE 97O assume $\eta^{\tau} = 0$ in their fit. Letting η^{τ} vary in the fit gives a $(\rho\xi)^{\tau}$ value of $0.87 \pm 0.27 \pm 0.04$.

[294] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E. ALBRECHT 95C uses events of the type $\tau^- \tau^+ \rightarrow (\ell^- \overline{\nu}_{\ell} \nu_{\tau})\ (h^+ h^- h^+ \overline{\nu}_{\tau})$ and their charged conjugates.

$(\delta\xi)^{\tau}(e)$ PARAMETER

$(V-A)$ theory predicts $(\delta\xi) = 0.75$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.734±0.028 OUR FIT				
0.731±0.029 OUR AVERAGE				
0.778±0.066±0.024	44k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.85 ±0.12 ±0.04	17k	ABREU 00L	DLPH	1992–1995 runs
0.72 ±0.31 ±0.14	25k	ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
0.56 ±0.14 ±0.06		[295] ALBRECHT 98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.85 ±0.43 ±0.08		ABE 97O	SLD	1993–1995 SLC runs
0.720±0.032±0.010	34k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.11 ±0.17 ±0.07		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[295] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

$(\delta\xi)^{\tau}(\mu)$ PARAMETER

$(V-A)$ theory predicts $(\delta\xi) = 0.75$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.778±0.037 OUR FIT				
0.79 ±0.04 OUR AVERAGE				
0.786±0.066±0.028	46k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.86 ±0.13 ±0.04	22k	ABREU 00L	DLPH	1992–1995 runs
0.63 ±0.23 ±0.05	27k	ACKERSTAFF 99D	OPAL	1990–1995 LEP runs
0.73 ±0.18 ±0.10		[296] ALBRECHT 98	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
0.82 ±0.32 ±0.07		ABE 97O	SLD	1993–1995 SLC runs
0.786±0.041±0.032	22k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.71 ±0.14 ±0.06		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[296] ALBRECHT 98 use tau pair events of the type $\tau^-\tau^+ \rightarrow (\ell^-\overline{\nu}_\ell\nu_\tau)(\pi^+\pi^0\overline{\nu}_\tau)$, and their charged conjugates.

$\xi^{\tau}(\pi)$ PARAMETER

$(V-A)$ theory predicts $\xi^{\tau}(\pi) = 1$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.993±0.022 OUR FIT				
0.994±0.023 OUR AVERAGE				
0.994±0.020±0.014	27k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.81 ±0.17 ±0.02		ABE 97O	SLD	1993–1995 SLC runs
1.03 ±0.06 ±0.04	2.0k	COAN 97	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.987±0.057±0.027		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E
0.95 ±0.11 ±0.05		[297] BUSKULIC 94D	ALEP	1990+1991 LEP run

[297] Superseded by BUSKULIC 95D.

$\xi^\tau(\rho)$ PARAMETER

$(V-A)$ theory predicts $\xi^\tau(\rho) = 1$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.994±0.008 OUR FIT				
0.994±0.009 OUR AVERAGE				
0.987±0.012±0.011	59k	HEISTER 01E	ALEP	1991–1995 LEP runs
0.99 ±0.12 ±0.04		ABE 97O	SLD	1993–1995 SLC runs
0.995±0.010±0.003	66k	ALEXANDER 97F	CLEO	E^{ee}_{cm}= 10.6 GeV
1.022±0.028±0.030	1.7k	[298] ALBRECHT 94E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.045±0.058±0.032		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E
1.03 ±0.11 ±0.05		[299] BUSKULIC 94D	ALEP	1990+1991 LEP run

[298] ALBRECHT 94E measure the square of this quantity and use the sign determined by ALBRECHT 90I to obtain the quoted result.

[299] Superseded by BUSKULIC 95D.

$\xi^\tau(a_1)$ PARAMETER

$(V-A)$ theory predicts $\xi^\tau(a_1) = 1$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.001±0.027 OUR FIT				
1.002±0.028 OUR AVERAGE				
1.000±0.016±0.024	35k	[300] HEISTER 01E	ALEP	1991–1995 LEP runs
1.02 ±0.13 ±0.03	17.2k	ASNER 00	CLEO	E^{ee}_{cm}= 10.6 GeV
1.29 ±0.26 ±0.11	7.4k	[301] ACKERSTAFF 97R	OPAL	1992–1994 LEP runs
0.85 $^{+0.15}_{-0.17}$ ±0.05		ALBRECHT 95C	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
1.25 ±0.23 $^{+0.15}_{-0.08}$	7.5k	ALBRECHT 93C	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.08 $^{+0.46}_{-0.41}$ $^{+0.14}_{-0.25}$	2.6k	[302] AKERS 95P	OPAL	Repl. by ACKERSTAFF 97R
0.937±0.116±0.064		BUSKULIC 95D	ALEP	Repl. by HEISTER 01E

[300] HEISTER 01E quote 1.000 ± 0.016 ± 0.013 ± 0.020 where the errors are statistical, systematic, and an uncertainty due to the final state model. We combine the systematic error and model uncertainty.

[301] ACKERSTAFF 97R obtain this result with a model independent fit to the hadronic structure functions. Fitting with the model of Kuhn and Santamaria (ZPHY **C48**, 445 (1990)) gives 0.87 ± 0.16 ± 0.04, and with the model of of Isgur *et al.* (PR **D39**,1357 (1989)) they obtain 1.20 ± 0.21 ± 0.14.

[302] AKERS 95P obtain this result with a model independent fit to the hadronic structure functions. Fitting with the model of Kuhn and Santamaria (ZPHY **C48**, 445 (1990)) gives 0.87 ± 0.27$^{+0.05}_{-0.06}$, and with the model of of Isgur *et al.* (PR **D39**,1357 (1989)) they obtain 1.10 ± 0.31$^{+0.13}_{-0.14}$.

ξ^τ(all hadronic modes) PARAMETER

$(V-A)$ theory predicts $\xi^\tau = 1$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.995±0.007 OUR FIT					
0.997±0.007 OUR AVERAGE					
0.992±0.007±0.008	102k	[303] HEISTER	01E	ALEP	1991–1995 LEP runs
0.997±0.027±0.011	39k	[304] ABREU	00L	DLPH	1992–1995 runs
1.02 ±0.13 ±0.03	17.2k	[305] ASNER	00	CLEO	E^{ee}_{cm}= 10.6 GeV
1.032±0.031	37k	[306] ACCIARRI	98R	L3	1991–1995 LEP runs
0.93 ±0.10 ±0.04		ABE	97O	SLD	1993–1995 SLC runs
1.29 ±0.26 ±0.11	7.4k	[307] ACKERSTAFF	97R	OPAL	1992–1994 LEP runs
0.995±0.010±0.003	66k	[308] ALEXANDER	97F	CLEO	E^{ee}_{cm}= 10.6 GeV
1.03 ±0.06 ±0.04	2.0k	[309] COAN	97	CLEO	E^{ee}_{cm}= 10.6 GeV
1.017±0.039		[310] ALBRECHT	95C	ARG	E^{ee}_{cm}= 9.5–10.6 GeV
1.25 ±0.23 $^{+0.15}_{-0.08}$	7.5k	[311] ALBRECHT	93C	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.970±0.053±0.011	14k	[312] ACCIARRI	96H	L3	Repl. by ACCIARRI 98R
1.08 $^{+0.46}_{-0.41}$ $^{+0.14}_{-0.25}$	2.6k	[313] AKERS	95P	OPAL	Repl. by ACKERSTAFF 97R
1.006±0.032±0.019		[314] BUSKULIC	95D	ALEP	Repl. by HEISTER 01E
1.022±0.028±0.030	1.7k	[315] ALBRECHT	94E	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
0.99 ±0.07 ±0.04		[316] BUSKULIC	94D	ALEP	1990+1991 LEP run

[303] HEISTER 01E quote 0.992 ± 0.007 ± 0.006 ± 0.005 where the errors are statistical, systematic, and an uncertainty due to the final state model. We combine the systematic error and model uncertainty. They use $\tau \to \pi\nu_\tau$, $\tau \to K\nu_\tau$, $\tau \to \rho\nu_\tau$, and $\tau \to a_1\nu_\tau$ decays.

[304] ABREU 00L use $\tau^- \to h^- \geq 0\pi^0\nu_\tau$ decays.

[305] ASNER 00 use $\tau^- \to \pi^- 2\pi^0\nu_\tau$ decays.

[306] ACCIARRI 98R use $\tau \to \pi\nu_\tau$, $\tau \to K\nu_\tau$, and $\tau \to \rho\nu_\tau$ decays.

[307] ACKERSTAFF 97R use $\tau \to a_1\nu_\tau$ decays.

[308] ALEXANDER 97F use $\tau \to \rho\nu_\tau$ decays.

[309] COAN 97 use $h^+ h^-$ energy correlations.

[310] Combined fit to ARGUS tau decay parameter measurements in ALBRECHT 95C, ALBRECHT 93G, and ALBRECHT 94E.

[311] Uses $\tau \to a_1\nu_\tau$ decays. Replaced by ALBRECHT 95C.

[312] ACCIARRI 96H use $\tau \to \pi\nu_\tau$, $\tau \to K\nu_\tau$, and $\tau \to \rho\nu_\tau$ decays.

[313] AKERS 95P use $\tau \to a_1\nu_\tau$ decays.

[314] BUSKULIC 95D use $\tau \to \pi\nu_\tau$, $\tau \to \rho\nu_\tau$, and $\tau \to a_1\nu_\tau$ decays.

[315] ALBRECHT 94E measure the square of this quantity and use the sign determined by ALBRECHT 90I to obtain the quoted result. Uses $\tau \to a_1\nu_\tau$ decays. Replaced by ALBRECHT 95C.

[316] BUSKULIC 94D use $\tau \to \pi\nu_\tau$ and $\tau \to \rho\nu_\tau$ decays. Superseded by BUSKULIC 95D.

τ REFERENCES

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AUBERT,BE	05D	PRL 95 191801	B. Aubert *et al.*	(BABAR Collab.)
ENARI	05	PL B622 218	Y. Enari *et al.*	(BELLE Collab.)
HAYASAKA	05	PL B613 20	K. Hayasaka *et al.*	(BELLE Collab.)
SCHAEL	05C	PRPL 421 191	S. Schael *et al.*	(ALEPH Collab.)
ABBIENDI	04J	EPJ C35 437	G. Abbiendi *et al.*	(OPAL Collab.)
ABDALLAH	04K	EPJ C35 159	J. Abdallah *et al.*	(DELPHI Collab.)
ABDALLAH	04T	EPJ C36 283	J. Abdallah *et al.*	(DELPHI Collab.)
ABE	04B	PRL 92 171802	K. Abe *et al.*	(BELLE Collab.)
ACHARD	04G	PL B585 53	P. Achard *et al.*	(L3 Collab.)
AUBERT	04J	PRL 92 121801	B. Aubert *et al.*	(BABAR Collab.)
ENARI	04	PRL 93 081803	Y. Enari *et al.*	(BELLE Collab.)
YUSA	04	PL B589 103	Y. Yusa *et al.*	(BELLE Collab.)
ABBIENDI	03	PL B551 35	G. Abbiendi *et al.*	(OPAL Collab.)
BRIERE	03	PRL 90 181802	R. A. Briere *et al.*	(CLEO Collab.)
HEISTER	03F	EPJ C30 291	A. Heister *et al.*	(ALEPH Collab.)
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HEISTER	01E	EPJ C22 217	A. Heister *et al.*	(ALEPH Collab.)
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ABBIENDI	00C	EPJ C13 213	G. Abbiendi *et al.*	(OPAL Collab.)
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ABREU	00L	EPJ C16 229	P. Abreu *et al.*	(DELPHI Collab.)
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ABBIENDI	99H	PL B447 134	G. Abbiendi *et al.*	(OPAL Collab.)
ABREU	99X	EPJ C10 201	P. Abreu *et al.*	(DELPHI Collab.)
ACKERSTAFF	99D	EPJ C8 3	K. Ackerstaff *et al.*	(OPAL Collab.)
ACKERSTAFF	99E	EPJ C8 183	K. Ackerstaff *et al.*	(OPAL Collab.)
BARATE	99K	EPJ C10 1	R. Barate *et al.*	(ALEPH Collab.)
BARATE	99R	EPJ C11 599	R. Barate *et al.*	(ALEPH Collab.)
BISHAI	99	PRL 82 281	M. Bishai *et al.*	(CLEO Collab.)
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ACCIARRI	98E	PL B434 169	M. Acciarri *et al.*	(L3 Collab.)
ACCIARRI	98R	PL B438 405	M. Acciarri *et al.*	(L3 Collab.)
ACKERSTAFF	98M	EPJ C4 193	K. Ackerstaff *et al.*	(OPAL Collab.)
ACKERSTAFF	98N	PL B431 188	K. Ackerstaff *et al.*	(OPAL Collab.)
ALBRECHT	98	PL B431 179	H. Albrecht *et al.*	(ARGUS Collab.)
BARATE	98	EPJ C1 65	R. Barate *et al.*	(ALEPH Collab.)
BARATE	98E	EPJ C4 29	R. Barate *et al.*	(ALEPH Collab.)
BLISS	98	PR D57 5903	D.W. Bliss *et al.*	(CLEO Collab.)
ABE	97O	PRL 78 4691	K. Abe *et al.*	(SLD Collab.)
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ALEXANDER	97F	PR D56 5320	J.P. Alexander *et al.*	(CLEO Collab.)
AMMAR	97B	PRL 78 4686	R. Ammar *et al.*	(CLEO Collab.)
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ABREU	96B	PL B365 448	P. Abreu *et al.*	(DELPHI Collab.)
ACCIARRI	96H	PL B377 313	M. Acciarri *et al.*	(L3 Collab.)
ACCIARRI	96K	PL B389 187	M. Acciarri *et al.*	(L3 Collab.)
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ALBRECHT	96E	PRPL 276 223	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	96D	PL B369 163	G. Alexander *et al.*	(OPAL Collab.)
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BUSKULIC	96	ZPHY C70 579	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	96C	ZPHY C70 561	D. Buskulic *et al.*	(ALEPH Collab.)
COAN	96	PR D53 6037	T.E. Coan *et al.*	(CLEO Collab.)
ABE	95Y	PR D52 4828	K. Abe *et al.*	(SLD Collab.)
ABREU	95T	PL B357 715	P. Abreu *et al.*	(DELPHI Collab.)
ABREU	95U	PL B359 411	P. Abreu *et al.*	(DELPHI Collab.)
ACCIARRI	95	PL B345 93	M. Acciarri *et al.*	(L3 Collab.)
ACCIARRI	95F	PL B352 487	M. Acciarri *et al.*	(L3 Collab.)
AKERS	95F	ZPHY C66 31	R. Akers *et al.*	(OPAL Collab.)
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ALBRECHT	95	PL B341 441	H. Albrecht *et al.*	(ARGUS Collab.)
ALBRECHT	95C	PL B349 576	H. Albrecht *et al.*	(ARGUS Collab.)
ALBRECHT	95G	ZPHY C68 25	H. Albrecht *et al.*	(ARGUS Collab.)
ALBRECHT	95H	ZPHY C68 215	H. Albrecht *et al.*	(ARGUS Collab.)
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BUSKULIC	95C	PL B346 371	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	95D	PL B346 379	D. Buskulic *et al.*	(ALEPH Collab.)
Also		PL B363 265 (erratum)	D. Buskulic *et al.*	(ALEPH Collab.)
ABREU	94K	PL B334 435	P. Abreu *et al.*	(DELPHI Collab.)
AKERS	94E	PL B328 207	R. Akers *et al.*	(OPAL Collab.)
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ADRIANI	93M	PRPL 236 1	O. Adriani *et al.*	(L3 Collab.)
ALBRECHT	93C	ZPHY C58 61	H. Albrecht *et al.*	(ARGUS Collab.)
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ACTON	92F	PL B281 405	D.P. Acton *et al.*	(OPAL Collab.)
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AKERIB	92	PRL 69 3610	D.S. Akerib *et al.*	(CLEO Collab.)
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ALBRECHT	92D	ZPHY C53 367	H. Albrecht *et al.*	(ARGUS Collab.)
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ALBRECHT	90E	PL B246 278	H. Albrecht et al.	(ARGUS Collab.)
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DELAGUILA	90	PL B252 116	F. del Aguila, M. Sher	(BARC, WILL)
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ALBRECHT	88L	ZPHY C41 1	H. Albrecht et al.	(ARGUS Collab.)
ALBRECHT	88M	ZPHY C41 405	H. Albrecht et al.	(ARGUS Collab.)
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BEHREND	88	PL B200 226	H.J. Behrend et al.	(CELLO Collab.)
BRAUNSCH...	88C	ZPHY C39 331	W. Braunschweig et al.	(TASSO Collab.)
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